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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

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ZOOLOGY—VOL. XVI.

PART XLVI.—REPORT ON THE REEF-CORALS

BY JOHN J. QUELCH, B.Sc. (LOND.)

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EDITORIAL NOTE.

THE collection of REEF-CORALS formed during the Expedition was a relatively small one, being chiefly made up of a few specimens from each of the localities visited. When, however, the collection was compared with that in the British Museum, it was found to be of much greater interest than was at first supposed. Mr. John J. Quelch, B.Sc., who made this comparison, was consequently induced to prepare the present detailed Report, which, in addition to the descriptions of new species, contains an important contribution to our knowledge of the geographical distribution of these animals.

The Manuscript was received in instalments between the 8th February and 28th April 1886.

JOHN MURRAY.

CHALLENGER OFFICE, 32 QUEEN STREET,
EDINBURGH, 15*th August* 1886.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the Reef-Corals collected by H.M.S. Challenger during the years 1873–76. By John J. Quelch, B.Sc. Lond., late Assistant, British Museum; Curator of the British Guiana Museum, Georgetown, Demerara.

PREFACE.

Some years after the return of the Challenger Expedition, the Reef-Corals collected during the voyage were sent to the British Museum; being of a more or less fragmentary character, it was not at first proposed to publish any detailed Report on the collection. The specimens were placed in my hands for examination and identification, and as on the whole they proved to be of very great interest, the following short Report was prepared at the request of Mr. John Murray, to whom I desire to express my obligation for the opportunity afforded me of visiting several Continental Museums in order to examine types and named specimens of Corals.

The Report, it was agreed, was to be short, limited both in its text and in its plates; and indeed my engagements and the conditions under which the work has been accomplished would have made it necessarily of such a nature.

That the Report is incomplete in many respects no one can be more fully aware than myself; but, on the one hand, it must be stated that this was necessarily so, owing to the limitations under which it was permitted, while, on the other hand, the time at my disposal for its completion has been so repeatedly and seriously interrupted, that it has been almost with a feeling of despair that the work has been brought even to its present form. It is consoling, however, to reflect that even though it is incomplete, the report will yet form a small contribution to our knowledge of the distribution of the Reef-Corals.

To Dr. Günther, F.R.S., my thanks are especially due, since it was at his direction that the examination of the Reef-Corals was undertaken, and owing to his kindness that an account of them was possible.

To Professor Perrier and Monsieur Poirier of the Museum of Natural History, Paris; to Dr. de Mann, late of the Leyden Museum, and to Professor von Martens of the University of Berlin, I am indebted not only for every assistance while engaged in the examination of the collections under their charge, but also for much personal kindness.

To Mr. R. Etheridge, sen., F.R.S., to Professor P. Martin Duncan, F.R.S., and especially to Mr. S. O. Ridley, M.A., I am indebted for much information and assistance on various points; while to Professor Moseley I am under obligation not only for suggestions of different kinds, but for assistance which I have derived from his published Notes by a Naturalist on the Challenger, in giving an account, where possible, of the conditions under which the Corals flourished on the reefs.

The plates have been drawn under my constant supervision, and I should like to make a special acknowledgment of the great pains which the artist, Mr. Gawan, has taken with them, and of the skill which he has brought to bear on them.

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INTRODUCTION.

ON THE REEF-CORALS DESCRIBED.

The Reef-Corals here described belong almost entirely to the Reef Madreporaria ; the remainder consisting of a few Millepores. With the more distinctive reef-forms have been included, for the sake of completeness, a few other species which were either dredged in rather deep water or were obtained from localities where no reefs existed. The term Reef-Coral, it must be confessed, is becoming rather vague in its signification ; since a true reef-building species may be found either in its reef-forming position, or in quite deep water, or in shallow water where no reefs are found. And while on the one hand many genera are characteristic of shallow water and the reef fauna, or of the deep sea, yet there are, on the other hand, many which are common to both ; and it is probable that extended investigation will increase the number of these at the expense of the former.

The collection of Reef-Corals made was a large and an important one, there being representatives of two hundred and ninety-three species, referable to sixty-nine genera ; and many of the species are represented by series of specimens which often present a considerable degree of variation.

The new species amount to one-fourth of the total number of species obtained, a result that is scarcely to be wondered at, considering the little that is known of the Corals of the vast number of Pacific and Indo-Pacific Islands. Of the seventy-three new species, seventy-one were obtained in the Pacific, and two in the Atlantic ; and this illustrates fairly well the comparative knowledge that we have of the two chief coral regions.

Of the sixty-nine genera represented in the collection, eight are new, the specimens on which they were founded being all obtained from the Pacific—a fact that is again extremely suggestive as to our want of knowledge of the coral fauna of that immense region.

It is perhaps advisable to notify here that in the distributional section, as well as in the above statements, the terms "new species" and "new genera" are applied to all forms made known by the Challenger, independently of the fact that some of these forms have been already described in a preliminary notice of the Challenger Reef-Corals, of which Part I. alone was published—the remainder being suppressed, as it was expected at that time that the Report would speedily be ready for the press.

No attempt has been made to give an account of the soft parts of the specimens which were preserved in spirit; for, apart from the consideration of want of time in which to carry out work of such a protracted nature and of such special difficulty, the circumstances and conditions under which the Report was written effectually prevented any such attempt being made. These specimens, however, were comparatively few in number, and moreover did not form part of the collection which was placed in my hands for examination. A systematic examination of them was nevertheless made, and the results incorporated in the Report.

Special attention must be called to the fact that the descriptions of the species apply to a specimen in which the calicles are perfect—a remark of much deeper significance than may appear. Owing to the fragile nature of many of the Corals, and more especially of their delicate septa, it is often an extremely difficult matter to prevent fracture of many of the parts. This is especially applicable to those species in which the septa are delicate and exsert; and about which there may be an entire misconception owing to injury of these parts. In many of the delicate specimens in the collection more or less considerable injury has taken place, which, however, has scarcely affected the more sheltered calicles in depressions of the surface or between the branches; and from these uninjured or less injured calicles the descriptions have been framed. A special case may be cited with reference to the genus *Galaxea*, in which species differ from each other notably in the exsert nature of the septa and in the prominence of the costæ. The degree of exsertness of the septa and of the prominence of the costæ may be considerably interfered with by a small account of friction, and on the most exposed parts of the corallum it will in many cases be found that it is impossible to find an accurately shaped calicle. This is clearly evidenced in two new species of the genus in the collection, *Galaxea aspera*, and *Galaxea fragilis*. In the figures that are given of the corallum, natural size, the species in each case is represented as it occurs in the collection in its injured state; the real structure, as determined by a close examination of the less injured calicles, is shown approximately by a figure of a restored calicle.

As the number of plates was by request to be limited, only the new forms have been figured; and in nearly every case only a small portion of the corallum, natural size, has been represented to show the general character. The description of the species supplies the habit of the form; and to possess the complete figure it is only necessary to amplify the portion figured to the stated shape and size. For all essential purposes of identification, the portion figured is believed to be sufficient when taken with the various magnified views. Had each new species been figured to show the natural size of a characteristic specimen, with the additional magnified details, and had all the previously described species, of which no satisfactory figure exists, been also represented, the number of plates must have been increased at least tenfold.

No complete re-descriptions of previously described species are given, but in all cases

where the specimens in the collection differ from the descriptions of the typical specimens, such differences have been noted; and where additional characters or interesting varietal forms are present, these are described often at considerable length. Re-examination and re-description of many of the old scattered type specimens are urgently required, and when these are forthcoming it is likely that some of the forms referred to old species, to which they present decided likeness, though differing in many stated particulars, will be found to be sufficiently characterized to be ranked as distinct species. Of the generic grouping of the large number of species described by Dana in his great work on the Zoophytes of the United States Exploring Expedition, the valuable revised list by Verrill, published in Dana's Corals and Coral Islands, is taken as the scheme; exception being made, however, in one or two instances in the revised specific determination. Revised specific *descriptions* with figures, however, are urgently needed of many of these forms.

Detailed synonymy of the species described by the old authors has not been given, since it has already been given at length by Milne-Edwards and Haime in their classical work, Histoire naturelle des Coralliaires; more modern synonyms of different species have been mentioned or indicated, however, in those cases where the synonymy is obvious.

Besides the reference to the description given by the author of the species, reference has been made in almost every case both to the re-description as given by Milne-Edwards and Haime in their great work, which thus serves as a handbook of reference for the species of the old authors, and to those later works in which additional light is thrown on the characters and affinities of the older as well as of the more recently described species, while additional references are given to those works in which good figures of the species are to be found.

No priority is given in any case to manuscript names; the published descriptions being alone referred to.

ON DISTRIBUTION.

In the treatment of the distribution of the Reef-Corals, lists have been given of the species which were obtained at each locality, together with lists of the new species, and of the old species which are now recorded for the first time from each station; while an attempt has been made to furnish in each case a complete list of the recognised species now known to occur there.

In order to give some idea of the local conditions under which the Corals flourish on the reefs, quotations bearing on the point have been given in all cases, where possible, from the observations of Professor Moseley, as stated in each case; unfortunately, however, the information at hand gives little or nothing of the conditions or surroundings peculiar to individual species. For information of this kind to be of any value, detailed

observation and even experiment would be essential; and this was naturally out of the question owing to the short period of time passed at each reef-station by the Challenger.

In the compilation of the lists of the species which are known to occur at each of the Challenger reef-stations, published localities have been alone considered, and with this limitation it is believed that the lists are fairly complete as regards the more definitely marked reef-building forms. Considerable difficulty has been experienced, however, in deciding between various simple forms, which, although not among the usually recognised reef-builders, are yet either shallow-water forms or forms from the comparatively deeper waters of the reef-areas.

In the case of many of the species described or recorded by the older authors, though it is certain that many of them must occur at one or more of the stations named, yet it was impossible to incorporate them owing to the want of a definite record of the locality; while, on the other hand, in many cases it seems to me equally impossible to be certain, either from the figures or from the descriptions, what species were really intended.

Though the lists may possibly be found incomplete, yet it must be pointed out, particularly to those who have not full opportunity for consulting the whole literature on the subject, that the simple record of a species is not always sufficient for its location, that often a knowledge of its history is required. Of this, a case in point may be taken from the record given by Dana of the occurrence of *Fungia echinata*, Pallas, in the Fiji Islands. Specimens from the East Indies (Singapore) and from the Fiji Islands were referred to this species by Dana; but it has been shown by Milne-Edwards and Haime that the specimens were not referable to *Fungia echinata*, but to a new species *Fungia danæ*, which they also record from Manilla as well as from the East Indies and the Fiji Islands. Following on this, however, it has been shown by Verrill that, while the original Singapore specimens of Dana are forms of *Fungia danæ*, the Fiji specimens are distinct and belong to a new species, *Fungia lacera;* so that while lists from Dana or from Milne-Edwards and Haime would include *Fungia echinata* or *Fungia danæ* from the Fiji Islands, the fact is that neither of these species is as yet recorded from that locality, but only the *Fungia lacera*.

The detailed list of the species now known from each locality has been given, with the hope not only that it will prove of use to those who may be working at the Fauna of the island or groups of islands represented, but more especially that it may serve as a basis for, or as a first instalment to, a knowledge of the distribution of the Reef-Corals.

Little or no attempt has been made to generalize from the facts at hand as to the relations of the Fauna of the various groups, since it was impossible not to recognise how incomplete was the knowledge of them that we at present possess. Nor does it seem possible that such generalizations can safely be made until at least such examinations of the Coral fauna of the chief groups of the Pacific and Indian Oceans have been made as have been accomplished in the case of the Corals of the Red Sea.

Observations and experiments on individual species of Reef-Corals are sadly needed in order to bring to light the influences of local conditions upon them, such for instance as—

1. The nature of the surface on which they grow, when sandy, muddy, or rocky.
2. The stillness of the water in sheltered positions, or the motion of currents or running water in exposed positions.
3. The difference in temperature in different positions.
4. The presence or absence of direct sunshine.
5. The saltness or brackishness of the water.
6. The clearness or turbidity of the water.
7. The position on the reef, as to depth from the surface of the water.
8. The position on the reef as to proximity to or distance from the shore or the outer verge of the reef, &c.

It is certainly remarkable to notice the great amount of variation to which apparently one and the same species is liable, as is evidenced where large series of specimens are at hand; and it is probable that such variations are brought about by the influence of one or more of the above conditions. This to a certain extent seems borne out by the fact, observed by Professor Moseley at Bermuda, that certain species seem to thrive best in direct sunshine or in shade, or inside sheltered places like small caverns; from which it seems natural to conclude that the presence of less favourable conditions in each case would be attended with more or less marked changes in the growth of the species.

The reefs at Tahiti, Banda, and Bermuda seem to offer special facilities for the prolonged examination, both by observation and experiment, of individual species under varying conditions.

ON CLASSIFICATION.

In the sketch which is given under this head, no detailed account of the families and genera of the Madreporaria has been attempted, for this has been rendered superfluous by Professor P. Martin Duncan's recent work, Revision of the Families and Genera of the Sclerodermic Zoantharia or Madreporaria.[1] As, however, considerable light has been thrown on many points of classification by the Challenger Reef-Corals, it was necessary that these points should be stated and considered; and this has been done, generally, in a very brief manner. I believe—and indeed modern investigation forces one to the conclusion—that no satisfactory classification of the Madreporaria is possible until much more is known of the structure of the soft parts of a large number of the genera which have been described from the corallum alone, and until the development of the hard structures, and the relations of the different parts to each other, are much better understood than they are at present.

[1] *Journ. Linn. Soc. Lond.* (Zool.), vol. xviii.

Of a large number of representative genera of Reef-Corals, little or nothing is known of the early stages of the growth either of their simple or of their colonial forms; nor, indeed, does it seem likely that such knowledge will be forthcoming, until some naturalist familiar with the subject has been enabled to collect and study the various types on the reefs.

In the treatment which has been given of the old group of the Rugosa, I have been warned, as indeed I am aware, that I shall probably be subjecting myself to a good deal of criticism; but the conclusions at which I have arrived seem to me unavoidable, when the essential characteristics of the main groups of the recent and fossil corals are compared. Nor would these conclusions be disturbed by the removal of many doubtful genera from the Madreporaria.

The question has been briefly discussed, and was rendered necessary to be discussed by the occurrence of the very remarkable form, *Moseleya latistellata*, the direct and close relationship of which to the most typical of the Cyathophyllidæ is self-evident, while at the same time it is also undeniably Astræid in its characters.

I was inclined at first to place the Cyathophyllidæ, together with *Moseleya*, definitely in the family Astræidæ as a subfamily Moseleyinæ; but it seems more advisable to consider the two families as distinct, *Moseleya* being placed with the Cyathophyllidæ. It is evident, however, that the essential distinctions between the two families are very slight.

Considering the extremely interesting relationships of *Moseleya*, it must be looked upon as one of the most remarkable types of structure brought to light by the Challenger.

ON THE LITERATURE.

It has not been thought necessary to give in this short work a list of the bibliography of the Reef-Corals, for while numerous works exist in which lists are given of the older works on the subject, full information of the more recent works has been given in the recently published and valuable volume by Professor D'Arcy Thompson, A Bibliography of Protozoa, Sponges, Cœlenterata, and Worms.

Constant reference has necessarily been made for the recent forms to the works of Dana, Milne-Edwards and Haime, Verrill, Pourtalès, Agassiz, Duchassaing and Michelotti, Duncan, Semper, Moseley, Lacaze-Duthiers, Lindström, Brüggemann, Studer, Klunzinger, Ridley, Tenison-Woods, &c., not to mention the older writers; and references to writings of the different authors are given in the systematic portion of the work under the genera and species.

GEOGRAPHICAL DISTRIBUTION.

The Reef Madreporaria collected were obtained from the Atlantic and Pacific regions, which in the case of the Reef Madreporaria generally are characterised, with but one doubtful exception, viz., *Isophyllia australis*, by the distinctness of the forms occurring in each.

ATLANTIC REGION.

Thirty-seven species of True Corals, representing fourteen genera, and three species of Hydrocorals, were collected in this region, and were obtained from the following localities:—

1. Bermuda.
2. St. Thomas (Danish West Indies).
3. St. Vincent (Cape Verde Islands).
4. Barra Grande (Brazil),
5. Simon's Bay (Cape of Good Hope).

1. Bermuda.

Since the communication of my note on the Bermuda Reef-Corals,[1] two additional species have come to light, making a total of twenty-three species of True Corals, representing nine genera, and two species of Hydrocorals, which were collected at Bermuda, thus more than doubling the number formerly known.

They comprise the following:—

Oculina coronalis, n. sp.
„ *speciosa*, Edw. and H.
„ *varicosa*, Lesr.
„ *pallens*, Ehrg.
„ *diffusa*, Lamk.
„ *bermudensis*, Duch. and Mich.
Madracis decactis, Lyman (=*Pentalophora decactis*).
Isophyllia strigosa, Duch. and Mich. (=*Isophyllia rigida*, Verrill).
„ *fragilis*, Dana.
„ *dipsacea*, Dana.
„ *australis*, Edw. and H.
„ *cylindrica*, Duch. and Mich.
„ *knoxi*, Duch. and Mich.
„ *marginata*, Duch. and Mich.

[1] Narr. Chall. Exp., vol. i. part. i. p. 145.

Mæandrina strigosa, Dana.	*Astræa coarctata*, Duch. and Mich.
,, *sinuosissima*, Edw. and H.	*Siderastræa galaxea*, Ell. and Sol.
,, *labyrinthica*, Ell. and Sol.	*Agaricia fragilis*, Dana.
Diploria cerebriformis, Lamk.	*Porites clavaria*, Lamk.
Astræa ananas, Ell. and Sol.	*Millepora alcicornis*, L.

Millepora ramosa, Pall.

The two species of *Millepora* are very abundant, and contribute largely to the reef formation. While some species, such as the great "Brain-Coral" (*Diploria cerebriformis*), which is conspicuous at the bottom as a bright yellow mass, appear to prefer to grow where the water is lighted up by the sunshine, other species, such as the *Millepora ramosa* and *Isophyllia dipsacea*, seem to thrive best in the shade. One species, *Agaricia fragilis*, which forms very thin and fragile plate-like laminæ, which are, when bleached white, almost the most beautiful of corals, occurs growing in colonies in great abundance in water from a foot to a fathom in depth inside small caverns.[1]

The genera *Astræa* (*Favia*) and *Mæandrina* are for the first time recorded with certainty from this locality; while the species which are new to the fauna comprise:—

Oculina coronalis.	*Isophyllia marginata* (?).
,, *speciosa*.	*Mæandrina strigosa*.
Isophyllia fragilis.	,, *sinuosissima*.
,, *australis*.	,, *labyrinthica*.
,, *cylindrica*.	*Astræa ananas*.
,, *knoxi*.	,, *coarctata*.

Millepora ramosa.

Of these the *Isophyllia fragilis* (=*Mussa fragilis*, Dana), and the *Mæandrina labyrinthica* were recorded by Dana as being found at Bermuda, in his Report on the Zoophytes of the United States Exploring Expedition; but both species have since been omitted from his list of the Bermuda Corals (Cor. and Cor. Islands, p. 114). They are therefore mentioned here as being found for the first time.

With the exception of *Oculina coronalis* (new species) and *Oculina bermudensis*, which at present are only known from Bermuda, the species are all West Indian and are such as one would expect to find. It is, however a noteworthy fact that no representative of the genus *Madrepora* is known to occur at Bermuda, although the three extremely variable species, *Madrepora palmata*, *Madrepora cervicornis* and *Madrepora prolifera*, are perhaps the most abundant, if not the most characteristic of the Reef-Corals of the West Indian Islands. It is possible that the genus does occur on the reefs, though it may be taken for granted, from the absence of representative forms in the collections of the "United States Exploring Expedition" and of the Challenger, that the specimens are

[2] Moseley, Notes by a Naturalist on the Challenger, p. 27.

neither abundant nor of considerable size. As the different species of *Madrepora* are generally characteristic of the warmer tropical waters, it is probable that the explanation of their rarity at, or absence from, Bermuda is to be found in the position of the islands, situated as they are at the extreme thermal limit for reef-building corals.

Besides the species obtained by the Challenger the following forms are also known to occur at Bermuda :—

Oculina valenciennesi, Edw. and H.
Lithophyllia cubensis, Edw. and H.
„ *lacera*, Pall. (= *Lithophyllia argemone*, Duch. and Mich.).
Isophyllia multilamella, Duch. and Mich. (= *Lithophyllia multilamella*, Duch. and Mich.)
„ *spinosa*, Edw. and H.
Millepora carthaginiensis, Duch. and Mich.

making a total of twenty-eight True Corals and three Hydrocorals which flourish on the reefs.

2. St. Thomas.

Thirteen species of True Corals, representing eight genera, and two species of Hydrocorals, were obtained. They include the following :—

Oculina varicosa, Lesr.
„ *diffusa*, Lamk.
„ *recta*, n. sp.
Pectinia profunda, Dana.
Manicina areolata, L.
Isophyllia aspera, Duch. and Mich.
Agaricia fragilis, Dana.
„ *frondosa*, Duch. and Mich.
Cladocora arbuscula, Lesr.
Madrepora palmata, Lamk.
„ *cervicornis*, Lamk.
„ *prolifera*, Lamk.
Porites astræoides, Lamk.
Millepora alcicornis, L.
„ *carthaginiensis*, Duch. and Mich.

The coral reefs of St. Thomas are remarkable for the large size and luxuriant growth of certain corals upon them, especially two species of the genus *Madrepora*, *Madrepora cervicornis*, and *Madrepora palmata*.[1]

Three species of Corals are recorded for the first time from this locality.

Oculina recta, n. sp. | *Agaricia fragilis*.
Madrepora cervicornis.

The complete list of the True Corals now known to occur at St. Thomas includes the following seventy-seven species :—

Oculina varicosa, Lesr.
„ *pallens*, Ehrg.
Oculina diffusa, Lamk.
„ *speciosa*, Edw. and H.

[1] Moseley, Notes by a Naturalist on the Challenger, p. 17.

Oculina recta, n. sp.
Madracis mirabilis, Duch. and Mich. (=*Stylophora mirabilis*, Duch. and Mich.).
„ *decactis*, Lyman (=*Stylophora incrustans*, Duch. and Mich. = *Reussia lamellosa*, Duch. and Mich.).
Lithophyllia radians, Duch. and Mich.
„ *cubensis*, Edw. and H.
„ *lacera*, Pall. (= *Lithophyllia argemone*, Duch. and Mich.).
„ *cylindrica*, Duch. and Mich.
„ *dubia*, Duch. and Mich.
Astrangia neglecta, Duch. and Mich.
„ *granulata*, Duch. and Mich.
„ *phyllangioides*, Duch. and Mich.
„ *solitaria*, Lesr.
Phyllangia reptans, Duch. and Mich.
Cladocora arbuscula, Lesr.
Eusmilia fastigiata, Pall. (=*Eusmilia aspera*, Duch. and Mich.).
„ *silene*, Duch. and Mich.
Mussa carduus, Ell. and Sol.
„ *sinuosa*, Lamk.
„ *angulosa*, Pall.
Diploria cerebriformis, Lamk.
Manicina areolata, L.
Mæandrina labyrinthica, Ell. and Sol.
„ *sinuosa*, Lesr.
Leptoria fragilis, Duch. and Mich.
Isophyllia strigosa, Duch, and Mich.
„ *aglæ*, Duch. and Mich.
„ *helianthus*, Duch. and Mich.
„ *conferta*, Duch. and Mich.
Isophyllia dipsacea, Dana.
„ *aspera*, Duch. and Mich.
„ *cylindrica*, Duch. and Mich.
„ *knoxi*, Duch. and Mich.
„ *sinuosa*, Verrill.
„ *marginata*, Duch. and Mich.
„ *verrucosa*, Duch. and Mich.
Mycetophyllia danæ, Edw. and H.
„ *lamarcki*, Edw. and H.
Colpophyllia astræiformis, Duch. and Mich.
„ *gyrosa*, Ell. and Sol.
Dichocœnia pauciflora, Duch. and Mich.
Astræa incerta, Duch. and Mich.
„ *coarctata*, Duch. and Mich.
„ *rotulosa*, Ell. and Sol.
„ *ananas*, Ell. and Sol.
„ *porcata*, Lamk. (?).
Goniastræa varia, Duch. and Mich.
Orbicella abdita, Duch. and Mich.
„ *cavernosa*, Esper.
Cyphastræa micans, Duch. and Mich.
„ *oblita*, Duch. and Mich.
Plesiastræa carpinetti, Duch. and Mich.
Leptastræa caribæa, Duch. and Mich.
Stephanocœnia debilis, Duch. and Mich.
„ *intersepta*, Esper.
„ *michelini*, Edw. and H.
Siderastræa galaxea, Ell. and Sol.
Agaricia purpurea, Lesr.
„ *agaricites*, Pall.
„ *vesparium*, Duch. and Mich.
„ *fragilis*, Dana.
„ *frondosa*, Duch. and Mich.
Madrepora prolifera, Lamk. (=*Madrepora ethica*, Duch. and Mich.).
„ *cervicornis*, Lamk.

Madrepora palmata, Lamk. (= *Madrepora flabellum*, Lamk. = *Madrepora alces*, Dana = *Madrepora cornuta*, Duch. and Mich. = *Madrepora thomasiana*, Duch. and Mich.).
Porites astræoides, Lamk.
Porites lævigata, Duch. and Mich.
„ *superficialis*, Duch. and Mich.
„ *subtilis*, Duch. and Mich.
„ *solanderi*, Duch. and Mich.
„ *furcata*, Lamk.
„ *incerta*, Duch. and Mich.
„ *plumieri*, Duch. and Mich.
„ *valida*, Duch. and Mich.

In connection with this list, however, it must be stated that very many of the species have been founded by Duchassaing and Michelotti, who, as pointed out by Pourtalès, have frequently described as new species slight varieties of well known and widely distributed forms. It is probable therefore that many of those enumerated are synonyms of old species, although the information at hand is not sufficient to determine the point with certainty.

3. St. Vincent, Cape Verde Islands.

Three species of true corals which are common to the West Indian reef fauna were collected. They comprise the following :—

Astræa fragum, Esper.
Porites superficialis, Duch. and Mich.
Porites guadalupensis, Duch. and Mich.

They form small rounded masses, bright yellow or whitish pink in colour, growing in the numerous rock pools which are exposed at low tide.[1]

4. Off Barra Grande, Brazil.

One species, *Orbicella cavernosa*, Esper, which is common to the West Indian reefs, was obtained at a depth of 30 fathoms. The occurrence of this definite Reef Coral in such a locality and depth is an extremely interesting fact.

5. Simon's Bay, Cape of Good Hope.

Two species were obtained :—*Manicina areolata*, L. ; and *Cladocora arbuscula*, Lesr., at a depth of 10 to 20 fathoms.

The latter species has been recorded already by Professor Moseley in the Report on the Deep-Sea Madreporaria, but it is included here for completeness.

The occurrence of the common West Indian Reef-Coral, *Manicina areolata*, so far south is an extremely interesting fact, to which special reference will be made in the remarks on the thermal limits to distribution.

[1] Moseley, Notes by a Naturalist on the Challenger, p. 47.

PACIFIC REGION.

Two hundred and forty-eight species of True Corals, representing fifty-eight genera, and five species of Hydrocorals, were collected in this region at the following districts :—

1. Tongatabu.
2. Fiji Islands (chiefly at Kandavu and Levuka).
3. Api, New Hebrides.
4. Australia (chiefly at Somerset, Cape York, and Wednesday Island.)
5. Banda.
6. Amboina.
7. Ternate.
8. Mactan Island, Philippines.
9. Samboangan, Philippines.
10. Honolulu.
11. Tahiti.

One species, *Rhodopsammia parallela*, Semper, was also obtained in the Arafura Sea, at a depth of 49 fathoms.

1. Tongatabu.

The following ten species, representing nine genera, were obtained :—

Stylophora prostrata, Klz.
Pocillopora suffruticosa, Verrill.
Cæloria leptoticha, Klz.
Caulastræa distorta, Dana.
Pavonia crassa, Dana.
Pavonia divaricata, Lamk.
Psammocora obtusangula, Lamk.
Turbinaria brassica, Dana.
Madrepora pocillifera, Lamk.
Porites arenosa, Esper.

The genera *Stylophora*, *Pocillopora*, *Cæloria*, *Caulastræa*, and *Turbinaria* are for the first time recorded from this locality, while the following six species are additions to the fauna :—

Stylophora prostrata.
Pocillopora suffruticosa.
Cæloria leptoticha.
Caulastræa distorta.
Pavonia crassa.
Turbinaria brassica.
Porites arenosa.

The following is a list of the Corals which are now known to occur at Tongatabu, comprising twenty-six species :—

Stylophora prostrata, Klz.
Pocillopora suffruticosa, Verrill.
Cæloria leptoticha, Klz.
Leptoria tenuis, Dana.
Caulastræa distorta, Dana.
Astræa danæ, Edw. and H.
Astræa amicorum, Edw. and H.
Acanthastræa spinosa, Edw. and H.
Prionastræa fusco-viridis, Quoy and Gaim.
,, *obtusata*, Edw. and H.
Orbicella solidior, Edw. and H.
Goniastræa quoyi, Edw. and H.
Cycloseris tenuis, Dana.

Pavonia crassa, Dana.
„ *divaricata*, Lamk.
Psammocora obtusangula, Lamk.
Turbinaria brassica, Dana.
Madrepora pocillifera, Lamk.
„ *verrucosa*, Edw. and H.
Madrepora abrotanoides, Lamk. (?).
„ *plantaginea*, Lamk. (?).
Montipora verrucosa, Lamk.
„ *papillosa*, Lamk.
Porites lutea, Edw. and H.
„ *arenosa*, Esper.
Porites levis, Dana.

2. Fiji Islands.

Fifty-nine species of True Corals, representing twenty-nine genera, and one Hydrocoral, were obtained. They were collected at—

(*a*) Kandavu.
(*b*) Levuka.
(*c*) Other Reefs, Fiji.

(a) **Kandavu.**—Thirty species of True Corals, representing eighteen genera, and one Hydrocoral were collected.

Speaking of the Corals at Kandavu, Professor Moseley writes :—" It is in the shallow sheltered water inside the actual edge of the barrier that the finest and best grown specimens of the Corals are to be found. The tufts, bushes, and rounded masses of the various Corals are to be seen growing here in abundance, but yet scattered over the area, with plenty of more or less barren interspaces in the ' Coral plantation ' as Dana terms it. The various forms of the spongy-tissued *Madreporas* are the characteristic feature in the Fijian reefs, there being no less than twenty-six species of *Madrepora* known from Fiji." " I saw however at Fiji no *Madreporas* so large and fine in growth as those of St. Thomas." [1]

The following is a list of the species obtained :—

Stylophora palmata, Blainv.
Seriatopora conferta, n. sp.
Galaxea fascicularis, L.
Mussa fistulosa, Edw. and H.
Cœloria dædalina, Dana.
„ *stricta*, Edw. and H.
„ *esperi*, Edw. and H.
Hydnophora microcona, Lamk.
Goniastræa cerium, Dana.
Astræa versipora, Dana.
Plesiastræa indurata, Verrill.
Plesiastræa urvillei, Edw. and H.
Prionastræa flexuosa, Dana.
„ *obtusata*, Edw. and H.
Acanthastræa irregularis, n. sp.
Lithactinia pileiformis, Dana.
„ *galeriformis*, Dana.
Stephanaria stellata, Verrill.
Dendrophyllia diaphana, Dana.
Madrepora nobilis, Dana.
„ *robusta*, Dana.
„ *seriata*, Ehrg.

[1] Notes by a Naturalist on the Challenger, pp. 306, 307.

Madrepora hebes, Dana.
„ *confraga*, n. sp.
„ *vastula*, n. sp.
Montipora caliculata, Dana.
Montipora foveolata, Dana.
Anacropora solida, n. sp.
Porites arenosa, Esper.
„ *crassistellata*, n. sp.
Millepora gonagra, Edw. and H.

(b) **Levuka.**—Seven species, representing four genera, were obtained from this locality.

Seriatopora hystrix, Dana.
Galaxea explanata, n. sp.
Agaricia regularis, n. sp.
Madrepora pustulosa, Edw. and H.
„ *scabrosa*, n. sp.
„ *rosaria*, Dana.
Madrepora hyacinthus, Dana.

(c) **Other Reefs, Fiji.**—Twenty-eight species, representing thirteen genera, of True Corals were collected at Fiji, on reefs other than those at Kandavu and Levuka. They comprise the following :—

Stylophora palmata, Blainv.
„ *prostrata*, Klz.
Pocillopora brevicornis, Lamk.
Seriatopora caliendrum, Ehrg.
„ *stellata*, n. sp.
Cæloria dædalina, Dana.
Hydnophora microcona, Lamk.
Prionastræa quoyi, Edw. and H.
Astræa danæ, Edw. and H.
Fungia confertifolia, Dana.
„ *valida*, Verrill.
Tichoseris obtusata, n. sp.
Turbinaria stellulata, Blainv.
Madrepora cuneata, Dana.
Madrepora robusta, Dana.
„ *echinata*, Dana.
„ *ramiculosa*, Dana.
„ *pocillifera*, Lamk.
„ *laxa*, Lamk.
„ *hebes*, Dana.
„ *conferta*, n. sp.
Montipora scabricula, Dana.
„ *levis*, n. sp.
„ *rubra*, Quoy and Gaim.
„ *palmata*, Dana.
„ *obtusata*, n. sp.
Porites arenosa, Esper.
„ *crassa*, n. sp.

Of the fifty-nine species obtained in the Fiji Islands, fifteen are new, namely :—

Seriatopora conferta.
„ *stellata.*
Galaxea explanata.
Acanthastræa irregularis.
Agaricia regularis.
Tichoseris obtusata.
Madrepora conferta.
Madrepora confraga.
„ *vastula.*
„ *scabrosa.*
Montipora levis.
„ *obtusata.*
Anacropora solida.
Porites crassa.
Porites crassistellata.

Of these one, *Tichoseris obtusata*, is the type of a new genus.

The following twenty-three species of True Corals, together with the preceding fifteen new species, make a total of thirty-six species, which are recorded for the first time from Fiji.

Stylophora prostrata.
Seriatopora caliendrum.
Mussa fistulosa.
Astræa danæ.
„ *versipora.*
Cœloria stricta.
„ *esperi.*
Goniastræa cerium.
Plesiastræa urvillei.
„ *indurata.*
Prionastræa obtusata.
Prionastræa quoyi.
Fungia valida.
Stephanaria stellata.
Dendrophyllia diaphana.
Madrepora nobilis.
„ *pustulosa.*
„ *seriata.*
„ *pocillifera.*
„ *laxa.*
Montipora rubra.
Porites arenosa.

The genera *Agaricia*, *Stephanaria* and *Anacropora*, are for the first time recorded from the Fijian Islands.

The following is a list of the Corals at present known from Fiji, comprising one hundred and ninety-eight species :—

Acrohelia horrescens, Dana.
Stylophora palmata, Blainv.
„ *digitata*, Blainv.
„ *mordax*, Dana.
„ *prostrata*, Klz.
Seriatopora caliendrum, Ehrg.
„ *hystrix*, Dana.
„ *stellata*, n. sp.
„ *pacifica*, Brüg.
„ *conferta*, n. sp.
Pocillopora brevicornis, Lamk.
„ *acuta*, Lamk.
„ *damicornis*, Esper.
„ *danæ*, Verrill.
„ *squarrosa*, Dana.
„ *elegans*, Dana.
„ *grandis*, Dana.
Pocillopora plicata, Dana.
Lithophyllia vitiensis, Brüg.
Mussa fistulosa, Edw. and H.
„ *cactus*, Dana.
„ *multilobata*, Dana.
„ *cerebriformis*, Dana.
Euphyllia rugosa, Dana.
Galaxea explanata, n. sp.
„ *fascicularis*, L.
„ *clavus*, Dana.
„ *hystrix*, Dana.
„ *cespitosa*, Esper.
Tridacophyllia pæonia, Dana.
Caulastræa furcata, Dana.
„ *distorta*, Dana.
Hydnophora microcona, Lamk.
Cœloria dædalea, Ell. and Sol.

Cœloria dædalina, Dana.
„ *stricta*, Edw. and H.
„ *esperi*, Edw. and H.
Leptoria gracilis, Dana.
„ *tenuis*, Dana.
Astræa danæ, Edw. and H.
„ *versipora*, Dana.
„ *pandanus*, Dana.
„ *pallida*, Dana.
Goniastræa favistella, Dana.
„ *cerium*, Dana.
„ *parvistella*, Dana.
Orbicella glaucopsis, Dana.
Prionastræa flexuosa, Dana.
„ *fusco-viridis*, Quoy and Gaim.
„ *virens*, Dana.
„ *sinuosa*, Dana.
„ *favulus*, Dana.
„ *robusta*, Dana.
„ *obtusata*, Edw. and H.
„ *quoyi*, Edw. and H.
Plesiastræa indurata, Verrill.
„ *urvillei*, Edw. and H.
„ *curta*, Dana.
„ *coronata*, Dana.
„ *stelligera*, Dana.
Acanthastræa irregularis, n. sp.
„ *patula*, Dana.
„ *echinata*, Dana.
Cyphastræa danæ, Edw. and H.
Leptastræa pulchra, Dana.
„ *purpurea*, Dana.
Merulina regalis, Dana.
„ *speciosa*, Dana.
„ *rigida*, Dana.
„ *scabricula*, Dana.
Acanthopora horrida, Dana.
Echinopora reflexa, Dana.
Cylicia truncata, Dana.
Fungia valida, Verrill.
„ *lacera*, Verrill.
„ *discus*, Dana.
„ *repanda*, Dana.
„ *dentata*, Dana.
„ *confertifolia*, Dana.
„ *scutaria*, Lamk.
„ *horrida*, Dana.
„ *gigantea*, Dana.
„ *crassa*, Dana.
Herpetolitha limax, Esper.
„ *crassa*, Dana.
Halomitra pileus, Dana (=*Halomitra clypeus*, Verrill).
Zoopilus echinatus, Dana.
Lithactinia galeriformis, Dana.
„ *pileiformis*, Dana.
Pavonia divaricata, Lamk.
„ *frondifera*, Lamk.
„ *cristata*, Ell. and Sol.
„ *decussata*, Dana.
„ *danæ*, Edw. and H.
„ *lata*, Dana.
„ *crassa*, Dana.
Siderastræa clavus, Dana.
Tichoseris obtusata, n. sp.
Agaricia regularis, n. sp.
Phyllastræa tubifex, Dana.
Pachyseris monticulosa, Verrill.
„ *valenciennesi*, Edw. and H.
Psammocora frondosa, Verrill.
„ *fossata*, Dana.
„ *columna*, Dana.
„ *exesa*, Dana.
Stephanaria stellata, Verrill.
Dendrophyllia diaphana, Dana.
„ *danæ*, Verrill.
„ *nigrescens*, Dana.

Turbinaria palifera, Lamk.
,, *peltata*, Esper.
,, *stellulata*, Blainv.
,, *frondens*, Dana.
,, *brassica*, Dana.
Astreopora profunda, Verrill.
,, *pulvinaria*, Lamk.
Madrepora spicifera, Dana.
,, *vastula*, n. sp.
,, *conferta*, n. sp.
,, *hyacinthus*, Dana.
,, *surculosa*, Dana.
,, *prostrata*, Dana.
,, *confraga*, n. sp.
,, *aculeus*, Dana
,, *tubicinaria*, Dana.
,, *valida*, Dana.
,, *retusa*, Dana.
,, *ramiculosa*, Dana.
,, *echinata*, Dana.
,, *carduus*, Dana.
,, *rosaria*, Dana.
,, *florida*, Dana.
,, *implicata*, Dana.
,, *tortuosa*, Dana.
,, *aspera*, Dana.
,, *nana*, Studer.
,, *hebes*, Dana.
,, *exigua*, Dana.
,, *cribripora*, Dana.
,, *virgata*, Dana.
,, *horrida*, Dana.
,, *rosacea*, Esper.
,, *arbuscula*, Dana.
,, *formosa*, Dana.
,, *gracilis*, Dana.
,, *pustulosa*, Edw. and H.
,, *robusta*, Dana.
,, *hystrix*, Dana.

Madrepora divaricata, Dana.
,, *scabrosa*, n. sp.
,, *abrotanoides*, Lamk.
,, *humilis*, Dana.
,, *pocillifera*, Lamk.
,, *nobilis*, Dana.
,, *seriata*, Ehrg.
,, *laxa*, Lamk.
,, *cuneata*, Dana.
Montipora levis, n. sp.
,, *obtusata*, n. sp.
,, *rubra*, Quoy and Gaim.
,, *caliculata*, Dana.
,, *verrucosa*, Lamk.
,, *palmata*, Dana.
,, *nodosa*, Dana.
,, *scabricula*, Dana.
,, *incrassata*, Dana.
,, *erosa*, Dana.
,, *danæ*, Edw. and H.
,, *planiuscula*, Dana.
,, *foveolata*, Dana.
,, *digitata*, Dana.
Anacropora solida, n. sp.
Porites arenosa, Esper.
,, *crassa*, n. sp.
,, *crassistellata*, n. sp.
,, *nigrescens*, Dana.
,, *mucronata*, Dana.
,, *levis*, Dana.
,, *palmata*, Dana.
,, *cylindrica*, Dana.
,, *lutea*, Edw. and H.
,, *fragosa*, Dana.
,, *lichen*, Dana.
,, *limosa*, Dana.
,, *reticulosa*, Dana.
,, *favosa*, Dana.
,, *cribripora*, Dana

Alveopora spongiosa, Dana.
Synaræa informis, Dana.
„ *danæ*, Edw. and H.
„ *monticulosa*, Dana.
Goniopora columna, Dana.
Dichoræa boletiformis, Ten.-Woods.
Millepora gonagra, Edw. and H.
„ *tortuosa*, Dana.
„ *platyphylla*, Ehrg.
„ *truncata*, Dana.

3. Api, New Hebrides.

Ten species of True Corals, representing seven genera, were collected at Api namely :—

Pocillopora brevicornis, Lamk.
Goniastræa laxa, n. sp.
Cyphastræa aspera, n. sp.
Pavonia decussata, Dana.
Madrepora millepora, Ehrg.
Madrepora pocillifera, Lamk.
„ *minima*, n. sp.
Porites tenuis, Verrill.
Montipora grandifolia, Dana.
Porites parvistellata, n. sp.

This is the first record of any collection of Reef-Corals from this locality. The conditions under which the forms grow seem to be unfavourable to their full development, and it is probable that the species which are to be found there are but few in number—a marked contrast to their remarkable abundance in the neighbouring Fijian Islands.

With reference to the Corals of Api, Professor Moseley writes "almost everywhere the living Corals are growing only laterally, the upper surfaces being dead from want of sufficient depth of water. In some small specimens of a massive *Porites*, the consequent flattening of the top and expansion of the lateral dimensions was most excellently shown in pieces convenient for museum purposes.

"The Corals, which were few in number of species, were finer grown towards the verge of the reef, as is always the case on shore platforms, the very opposite condition to that which holds in the case of barrier reefs. In some places were deep holes in the coral platform, reminding one of glacier crevasses on a small scale, evidently arising from the loose nature of the sloping beach on which the coral structure here rests.

"A massive *Porites* was one of the Corals on the reef. Some specimens of this species were unattached, though living, being in the form of rounded masses, entirely covered by living polyps, and I suppose from time to time rolled over by the waves."[1]

Of the ten species which were collected, the following four are new :—

Goniastræa laxa.
Cyphastræa aspera.
Madrepora minima.
Porites parvistellata.

[1] Notes by a Naturalist on the Challenger, p. 343.

Four species are characterised as being the most abundant reef-forming species, namely :—

Pocillopora brevicornis.
Pavonia decussata.
Goniastræa laxa.
Madrepora millepora.

To judge from the specimens which were obtained, the Corals of Api, on the whole, seem to be of extremely small growth.

4. Australia.

Seventeen species of True Corals, representing ten genera, were obtained. They were collected chiefly at Somerset, Cape York, and at Wednesday Island. The exact locality for one species, *Dendrophyllia conferta*, n. sp., is unknown.

(a) **Somerset, Cape York.**—Eleven species of True Corals, representing seven genera, were obtained, (1) from the shore at low tide, (2) from a depth of 5 fathoms.

"The sandy beach slopes down to end abruptly on a nearly horizontal mud-flat, bare at low water, which is mainly calcareous, and in fact a shore-platform reef, but with few living Corals on it." [1]

Seven species were obtained from the shore at low tide, namely :—

Euphyllia glabrescens, Chamisso.
„ *turgida*, Dana.
„ *striata*, Edw. and H.
Goniastræa quoyi, Edw. and H.
Turbinaria peltata, Esper.
„ *cinerascens*, Ell. and Sol.
Turbinaria crater, Pall.

Four species were obtained from a depth of 5 fathoms, namely:—

Stylophora digitata, Blainv.
Galaxea musicalis, Esper.
Mussa aspera, Edw. and H.
Alveopora retusa, Verrill.

(b) **Wednesday Island.**—Six species of Corals representing four genera, were dredged at a depth of eight fathoms.

Moseleya latistellata, n. sp.
Dendrophyllia axifuga, Edw. and H.
Turbinaria crater, Pall.
Turbinaria patula, Dana.
„ *æqualis*, n. sp.
Montipora exserta, n. sp.

Of the seventeen species from the Australian region, four are new, namely:—

Dendrophyllia conferta.
Turbinaria æqualis.
Montipora exserta.
Moseleya latistellata.

The last being the type of a new genus.

[1] Moseley, Notes by a Naturalist on the Challenger, p. 360.

In addition to these the following ten species are recorded for the first time from the Australian region:—

Stylophora digitata.
Galaxea musicalis.
Euphyllia turgida.
„ *striata.*
Mussa aspera.
Goniastræa quoyi.
Turbinaria peltata.
„ *crater.*
„ *patula.*
Alveopora retusa.

This is also the first record of the occurrence of the genera *Galaxea*, *Stylophora* and *Montipora*.

The complete list of the Reef-Corals now known to occur in Australia includes the following sixty-one species:—

Amphihelia venusta, Edw. and H.
Stylophora digitata, Blainv.
Seriatopora subulata, Lamk.
„ *cervina*, Lamk.
Pocillopora acuta, Lamk.
Galaxea musicalis, Esper.
Euphyllia glabrescens, Chamisso.
„ *turgida*, Dana.
„ *striata*, Edw. and H.
„ *rugosa*, Dana.
Antillia constricta, Brüg.
Mussa aspera, Edw. and H.
„ *grandis*, Edw. and H.
„ *solida*, Tenison-Woods.
„ *laciniata*, Tenison-Woods.
Isophyllia (*Homophyllia*) *australis*, Edw. and H.
Symphyllia hemispherica, Tenison-Woods.
Goniastræa quoyi, Edw. and H.
„ *grayi*, Edw. and H.
Astræa bowerbanki, Edw. and H.
Orbicella annuligera, Edw. and H.
Prionastræa australiensis, Edw. and H.
Acanthastræa bowerbanki, Edw. and H.
Plesiastræa urvillei, Edw. and H.
„ *peroni*, Edw. and H.
Cyphastræa microphthalma, Lamk.
„ *muelleri*, Edw. and H.
Merulina ramosa, Edw. and H.
Echinopora rosularia, Lamk.
Cylicia tenella, Dana.
„ *verreauxi*, Edw. and H.
„ *magna*, Tenison-Woods.
„ *quinaria*, Tenison-Woods.
Fungia dentata, Dana.
Cycloseris cyclolites, Lamk.
„ *tenuis*, Dana (= *Cycloseris hexagonalis*), Edw. and H.
„ *sinensis*, Edw. and H (?).
„ *mortoni*, Tenison-Woods.
Pavonia cristata, Ell. and Sol.
„ *frondifera*, Lamk.
Psammoseris cylicioides, Tenison-Woods.
Plesioseris australiæ, Rousseau.
Dendrophyllia aurea, Quoy and Gaim.
„ *axifuga*, Edw. and H.
„ *granosa*, Studer.
„ *conferta*, n. sp.
Endopachys australiæ, Tenison-Woods.

Heteropsammia michelini, Edw. and H.
Balanophyllia elliptica, Tenison-Woods.
„ *buccina*, Tenison-Woods.
Madrepora globiceps, Dana (?).
Turbinaria peltata, Esper.
„ *cinerascens*, Ell. and Sol.
„ *crater*, Pall.
Turbinaria æqualis, n. sp.
„ *patula*, Dana.
Porites gaimardi, Edw. and H.
Rhodaræa calicularis, Lamk.
Montipora exserta, n. sp.
Alveopora retusa, Verrill.
Moseleya latistellata, n. sp.

5. Banda.

Thirty six species of True Corals, representing twenty one-genera, were collected.

"At the base of the Banda volcano, on the shores of the island, a belt of living Corals composed of a considerable variety of species is easily accessible at low tide. Of these Corals the largest bulk is composed of massive Astræids, of which about ten different forms were collected. A massive *Porites* is also very abundant.

"One species of 'Brain-Coral' and an *Astræa* form huge masses, often as much as five feet in diameter, which have their bases attached to the bare basaltic rock of the shore. The tops of all these coral masses are dead and flat and somewhat decayed, but on these dead tops fresh growth is now taking place, showing that slight oscillations in the level of the shore of a foot at least have taken place recently. The tops of the Corals have been certainly killed by being left exposed above water.

"Such slight oscillations are to be expected at the base of an active volcano. The present regrowth is due to the Corals being now again submerged. The fact that these Corals are to be seen growing on the bare rock itself, and not on the débris of older Corals, shows that the coral growth is very recent.

"The Brain-Coral grows in convex, mostly hemispherical masses; the *Astræa* more in the form of vertically standing cylindrical masses, or masses which may be described as made up of a large number of cylinders fused together. The masses of the *Astræa* are usually higher than those of the 'Brain-Coral' by about a foot, because they are able to grow in shallower water, and they thus range also higher up on the beach.

"Many of the masses of this *Astræa* in the shallower water are left dry at each low tide, and appear to suffer no more in consequence than do the common sea-anemones of our English coasts, which are so closely allied to them. I have not seen any other species of Coral thus growing where it is exposed at low tide. The 'Brain-Coral' apparently cannot survive exposure, and hence the tips of its masses have been killed during the change of depth of the water, at about a foot below the height at which those of the *Astræa* have perished.

"The common Mushroom Coral, so often to be seen as a chimney ornament in England (*Fungia* sp.), is most extraordinarily abundant on the shore, at a depth of one or two

feet at low water, and with it an allied larger similarly free growing Coral, *Herpetolitha*. The Mushroom Corals cover the bottom in places in such large quantities, that a cart load of them might be picked up in a very short time; I have nowhere seen them so common."[1]

The species collected include the following:—

Acrohelia horrescens, Dana.
Pocillopora acuta, Lamk.
Seriatopora cervina, Lamk.
Euphyllia glabrescens, Chamisso.
Mussa multilobata, Dana.
Symphyllia acuta, n. sp.
Physogyra aperta, n. sp.
Ulophyllia aspera, n. sp.
„ *cellulosa*, n. sp.
Tridacophyllia manicina, Dana.
Goniastræa quoyi, Edw. and H.
„ *eximia*, Dana.
„ *favistella*, Dana.
„ *coronalis*, n. sp.
Astræa doreyensis, Edw. and H.
„ *speciosa*, Dana.
„ *pandanus*, Dana.
Hydnophora demidoffi, Fischer.
Phymastræa aspera, n. sp.
Merulina crispa, Dana.
Fungia repanda, Dana.
„ *plana*, Studer.
„ *confertifolia*, Dana.
„ *patella*, Ell. and Sol.
Herpetolitha crassa, Dana.
Madrepora securis, Dana.
„ *diffusa*, Verrill.
„ *capillaris*, Klz.
„ *tubigera*, Horn.
„ *mirabilis*, n. sp.
Montipora fragilis, n. sp.
„ *levis*, n. sp.
Anacropora gracilis, n. sp.
Porites gaimardi, Edw. and H.
„ *arenosa*, Esper.
Astreopora profunda, Verrill.

This collection of Reef Corals is the first which has been made in this locality of which there is any published description, and it is perhaps due to this fact that so many of the species are new.

The following ten species are new:—

Symphyllia acuta.
Physogyra aperta.
Ulophyllia aspera.
„ *cellulosa*.
Goniastræa coronalis.
Phymastræa aspera.
Madrepora mirabilis.
Montipora fragilis.
„ *levis*.
Anacropora gracilis

Of these, one, *Physogyra aperta*, is the type of a new genus.

[1] Moseley, Notes by a Naturalist on the Challenger, p. 385.

6. Amboina.

Twenty-five species of True Corals, representing eighteen genera, and one Hydrocoral, were collected.

"The coral banks, though abundant, were not so easily accessible at Amboina as at Banda, being in deeper water, and specimens of most of the species could only be procured by deep wading and diving." [1]

"A striking feature about the Corals of Amboina is the occurrence of several foliated forms in abundance, which form thin and fragile vertical plates." [2]

The species collected consist of the following :—

Stylophora digitata, Blainv.
Pocillopora acuta, Dana.
Euphyllia rugosa, Dana.
Mussa echinata, Edw. and H.
„ *brueggemanni*, n. sp.
Galaxea aspera, n. sp.
„ *fragilis*, n. sp.
Tridacophyllia manicina, Dana.
Goniastræa multilobata, n. sp.
Prionastræa robusta, Dana.
Fungia repanda, Dana.
„ *patella*, Ell. and Sol.
Cryptabacia talpina, Lamk.
Podabacia robusta, n. sp.
Psammocora excesa, Dana.
Oxypora contorta, n. sp.
Madrepora effusa, Dana.
„ *cerealis*, Dana.
„ *gracilis*, Dana.
„ *appressa*, Ehrg.
Turbinaria crater, Pall.
Montipora foliosa, Pall.
„ *patula*, Verrill.
Porites palmata, Dana.
Rhodaræa tenuidens, n. sp.
Millepora intricata, Edw. and H.

Of these, seven species are new, namely :—

Mussa brueggemanni.
Galaxea aspera.
„ *fragilis.*
Goniastræa multilobata.
Podabacia robusta.
Oxypora contorta.
Rhodaræa tenuidens.

This collection affords the first reliable information that we have of any large number of Corals found in this locality ; for although many specimens were described and figured by Rumphius (Herb. Amboin. VI.), yet, owing to the incompleteness and indefiniteness of the figures and descriptions, it is impossible to state with certainty which species were intended.

The following three species, *Porites saccharata*, Brüg., *Pachyseris speciosa*, Dana, *Astræa amboinensis*, Quoy and Gaimard, also occur at Amboina, making a total of twenty-eight species of True Corals and one Hydrocoral which are now recorded from this locality.

[1] Moseley, Notes by a Naturalist on the Challenger, p. 388. [2] Moseley.

7. Ternate.

Eleven species of True Corals, representing eight genera, and one Hydrocoral, were obtained from the Resident at Ternate. They include the following :—

Amphihelia infundibulifera, Lamk.
Stylophora palmata, Blainv.
Pocillopora paucistellata, n. sp.
,, *squarrosa*, Dana.
Seriatopora aculeata, n. sp.
,, *gracilis*, Dana.
Tridacophyllia manicina, Dana.
Fungia tenuidens, n. sp.
Merulina prolifera, n. sp.
Madrepora secale, Studer.
,, *rosacea*, Esper.
Millepora confertissima, n. sp.

Of these, the following five species are new :—

Pocillopora paucistellata.
Seriatopora aculeata.
Fungia tenuidens.
Merulina prolifera.
Millepora confertissima.

This is the first record of any collection of Reef Corals from this locality.

8. Mactan Island, Cebu.

Nineteen species of True Corals, representing thirteen genera, were obtained.

"Opposite the town of Cebu, the island of Mactan is bordered by a wide belt of denuded coral flat, partly covered at high tide. The surface is scooped out into irregular basins and sharp projecting pinnacles, and covered in all directions with mud, resulting from the denudation. Very few living Corals are to be found on these flats, but the flats are fringed at their seaward margin by small beds of living Corals."[1]

The following comprise the species collected :—

Pocillopora acuta, Lamk.
Seriatopora crassa, n. sp.
Galaxea ellisii, Edw. and H.
Trachyphyllia amarantus, Dana.
Astræa ordinata, Verrill.
,, *fragilis*, Dana.
Cyphastræa pleiades, Ell. and Sol.
,, *microphthalma*, Lamk.
,, *brueggemanni*, n. sp.
Goniastræa grayi, Edw. and H.
Fungia repanda, Dana.
Halomitra tiara, Verrill.
Madrepora austera, Dana.
,, *aspera*, Dana.
Montipora rigida, Verrill.
,, *erosa*, Dana.
Porites lutea, Edw. and H.
,, *mirabilis*, n. sp.
Goniopora pedunculata, Quoy and Gaim.

[1] Moseley, MS. Diary.

Of these three species are new :—

Seriatopora crassa. | *Cyphastræa brueggemanni.*
Porites mirabilis.

Montipora rigida is the most abundant reef-forming species.

9. Samboangan.

Forty-two species of True Corals, representing sixteen genera, and two Hydrocorals, were collected.

"The beach of the island was almost entirely composed of Coral débris. The main part of the mass was made up of the lighter, more friable perforated Corals. The considerable abundance of *Millepora* and great quantity of *Tubipora* was remarkable and characteristic. There are no extensive series of reefs about Samboangan, merely fringing reefs of small extent. In the full wash of the tide in the channel the shore is sandy and muddy and apparently without Corals." [1]

The species collected comprise the following :—

Stylophora flabellata, n. sp.
„ *cellulosa*, n. sp.
Pocillopora damicornis, Esper.
„ *danæ*, Verrill.
Seriatopora caliendrum, Ehrg.
„ *valida*, Ehrg.
„ *contorta*, Studer.
„ *ocellata*, Ehrg.
„ *compressa*, Studer.
„ *cervina*, Lamk.
Galaxea tenella, Brüg.
„ *clavus*, Dana.
Symphyllia sinuosa, Quoy and Gaim.
Hydnophora tenella, n. sp.
Fungia paumotensis, Stutchb.
Cycloseris tenuis, Dana.
„ *cyclolites*, Lamk.
„ *distorta*, Michelin.
„ *sinensis*, Edw. and H.
Cycloseris discus, n. sp.
„ *freycineti*, Edw. and H.
Rhodopsammia parallela, Semper.
Psammocora ramosa, n. sp.
Dendrophyllia equiserialis, Edw. and H.
Madrepora angulata, n. sp.
„ *canalis*, n. sp.
„ *manni*, n. sp.
„ *securis*, Dana.
„ *rosacea*, Esper.
„ *tenuis*, Dana.
„ *aculeus*, Dana.
„ *parilis*, n. sp.
„ *prostrata*, Dana.
Montipora effusa, Dana.
„ *exesa*, Verrill.
„ *irregularis*, n. sp.
„ *lima*, Lamk.
Porites palmata, Dana.

[1] Moseley, MS. Diary.

Porites explanata, n. sp.
Rhodaræa calicularis, Lamk.
„ *tenuidens*, n. sp.
Tichopora tenella, n. sp.
Millepora murrayi, n. sp.
„ *gonagra*, Edw. and H.

Of these the following fourteen are new species :—

Stylophora flabellata.
„ *cellulosa.*
Psammocora ramosa.
Hydnophora tenella.
Cycloseris discus.
Madrepora angulata.
„ *canalis.*
Madrepora manni.
„ *parilis.*
Montipora irregularis.
Porites explanata.
Rhodaræa tenuidens.
Tichopora tenella.
Millepora murrayi.

One of these, *Tichopora tenella*, is the type of a new genus.

This is the first published record which gives an account of the Reef-Corals of Samboangan. Many other species than those included have been recorded from the Sulu Sea and from the Philippines generally, which doubtless will be found to flourish at or about Samboangan.

The Reef-Corals now known from the Philippines and Sulu Sea include the following ninety-four species :—

Stylophora digitata, Blainv.
„ *flabellata*, n. sp.
„ *cellulosa*, n. sp.
Pocillopora acuta, Lamk.
„ *damicornis*, Esper.
„ *danæ*, Verrill.
„ *verrucosa*, Ell. and Sol.
Seriatopora caliendrum, Ehrg.
„ *valida*, Ehrg.
„ *contorta*, Studer.
„ *ocellata*, Ehrg.
„ *compressa*, Studer.
„ *cervina*, Lamk.
„ *octoptera*, Ehrg.
„ *gracilis*, Dana.
„ *crassa*, n. sp.
Ulangia stokesana, Edw. and. H.
Cladocora conferta, Dana.
Galaxea tenella, Brüg.
Galaxea ellisii, Edw. and H.
„ *clavus*, Dana.
„ *fascicularis*, L.
„ *hexagonalis*, Edw. and H.
Lithophyllia lacrymalis, Edw. and H.
Trachyphyllia amarantus, Dana.
Symphyllia sinuosa, Quoy and Gaim.
Hydnophora tenella, n. sp.
Astræa ordinata, Verrill.
„ *fragilis*, Dana.
Cyphastræa pleiades, Ell. and Sol.
„ *microphthalma*, Lamk.
„ *brueggemanni*, n. sp.
Goniastræa grayi, Edw. and H.
Merulina crispa, Dana.
„ *laxa*, Dana.
Echinopora undulata, Dana.
Fungia patella, Ell. and Sol.
„ *dentata*, Dana.

Fungia danæ, Edw. and H.
„ *repanda*, Dana.
„ *paumotensis*, Stutchb.
Halomitra tiara, Verrill.
Cryptabacia talpina, Lamk.
Cycloseris tenuis, Dana (= *Cycloseris hexagonalis*, Edw. and H).
„ *cyclolites*, Lamk.
„ *distorta*, Michelin.
„ *sinensis*, Edw. and H.
„ *discus*, n. sp.
„ *freycineti*, Edw. and H.
Pavonia danæ, Edw. and H.
Leptoseris papyracea, Dana.
Trochoseris stokesi, Edw. and H.
Haloseris crispa, Ehrg.
Psammocora ramosa, n. sp.
Rhodopsammia parallela, Semper.
Heteropsammia michelini, Edw. and H.
„ *multilobata*, Moseley.
Dendrophyllia equiserialis, Edw. and H.
Madrepora labrosa, Dana.
„ *securis*, Dana.
„ *prostrata*, Dana.
„ *austera*, Dana.
„ *canalis*, n. sp.
„ *aspera*, Dana.
„ *manni*, n. sp.
Madrepora angulata, n. sp.
„ *aculeus*, Dana.
„ *rosacea*, Esper.
„ *tenuis*, Dana.
„ *parilis*, n. sp.
„ *echidnæa*, Lamk.
„ *cerealis*, Dana.
„ *formosa*, Dana.
„ *gracilis*, Dana.
„ *arbuscula*, Dana.
„ *brachiata*, Dana.
„ *echinata*, Dana.
Montipora effusa, Dana.
„ *rigida*, Verrill.
„ *exesa*, Verrill.
„ *irregularis*, n. sp.
„ *erosa*, Dana.
„ *lima*, Lamk.
Porites palmata, Dana.
„ *mirabilis*, n. sp.
„ *explanata*, n. sp.
„ *lutea*, Edw. and H.
Rhodaræa calicularis, Lamk.
„ *tenuidens*, n. sp.
Tichopora tenella, n. sp.
Goniopora pedunculata, Quoy and Gaim.
Synaræa erosa, Dana.
Millepora murrayi, n. sp.
Millepora gonagra, Edw. and H.

10. Honolulu.

Twelve species of True Corals, representing four genera, were collected. They comprise the following :—

Pocillopora cespitosa, Dana.
„ *ligulata*, Dana.
„ *nobilis*, Verrill.
„ *verrucosa*, Ell. and Sol.
„ *plicata*, Dana.
Stephanaria stellata, Verrill.
Montipora capitata, Dana.
„ *verrucosa*, Lamk.
Porites lichen, Dana.
„ *compressa*, Dana.
„ *bulbosa*, n. sp.
„ *tenuis*, Verrill.

Of these one species, *Porites bulbosa*, is a new one, while five other species are recorded for the first time, namely :—

Pocillopora verrucosa.
Stephanaria stellata.
Montipora verrucosa.
Porites lichen.
Porites tenuis.

The complete list of the Reef-Corals now known from the Sandwich Islands includes the following thirty species :—

Pocillopora cespitosa, Dana.
,, *ligulata*, Dana.
,, *nobilis*, Verrill.
,, *aspera*, Verrill.
,, *plicata*, Dana.
,, *verrucosa*, Ell. and Sol.
,, *mæandrina*, Dana.
,, *informis*, Dana.
,, *frondosa*, Verrill.
Astræa hombroni, Rousseau (?).
,, *rudis*, Verrill (?).
Cœlastræa tenuis, Verrill (?).
Leptastræa stellulata, Verrill.
Cyphastræa ocellina, Dana.
Fungia paumotensis, Stutchb.
,, *verrilliana*, Quelch = *Fungia* (*Lobactis*) *danæ*, Verrill = *Fungia dentigera*, Dana, non *Fungia dentigera*, Leuck.
Pavonia varians, Verrill.
Stephanaria stellata, Verrill.
Dendrophyllia manni, Verrill.
Montipora capitata, Dana.
,, *verrucosa*, Lamk.
,, *patula*, Verrill.
Porites lichen, Dana.
,, *compressa*, Dana.
,, *bulbosa*, n. sp.
,, *tenuis*, Verrill.
,, *mordax*, Dana.
,, *lobata*, Dana.
Alveopora verrilliana, Dana.
Synaræa irregularis, Verrill.

It is a noteworthy peculiarity of the Coral fauna of the Sandwich Islands that no representative of the widely distributed genus *Madrepora* is found on the reefs.

11. Tahiti.

Forty species of True Corals, representing fourteen genera, and two Hydrocorals, were collected. They comprise the following :—

Pocillopora grandis, Dana.
,, *solida*, n. sp.
,, *cespitosa*, Dana.
Leptastræa ehrenbergana, Edw. and H.
,, *roissyana*, Edw. and H.
Leptastræa transversa, Klz.
,, *solida*, Edw. and H.
Fungia horrida, Dana.
,, *rugosa*, n. sp.
,, *acutidens*, Studer.

Fungia scutaria, Lamk.
„ *paumotensis*, Stutchb.
„ *concinna*, Verrill.
„ *discus*, Dana.
Sandalolitha dentata, n. sp.
Pavonia formosa, Dana.
„ *prætorta*, Dana.
Pachyseris speciosa, Dana.
Domoseris porosa, n. sp.
„ *solida*, n. sp.
„ *regularis*, n. sp.
Trochoseris stokesi, Edw. and H.
Cylloseris incrustans, n. sp.
Madrepora retusa, Dana.
„ *plantaginea*, Lamk.
„ *virgata*, Dana.
Madrepora danæ, Verrill.
„ *nasuta*, Dana.
„ *paxilligera*, Dana.
„ *speciosa*, n. sp.
„ *cytherea*, Dana.
„ *surculosa*, Dana.
„ *laxa*, Lamk.
„ *parilis*, n. sp.
Montipora aspera, Verrill.
„ *papillosa*, Lamk.
Porites arenosa, Esper.
„ *latistellata*, n. sp.
Synaræa convexa, Verrill.
Napopora irregularis, n. sp.
Millepora nodosa, Esper.
„ *gonagra*, Edw. and H.

"The most abundant reef-forming species on the reefs about Papiete are the species of *Pavonia*. With them are associated in quantity the species of *Porites*, the *Madrepora*, and the *Montipora*. The *Astræa* (*Leptastræa*) occurs in very small masses, and contributes no appreciable part of the reef mass. The *Fungias* are so abundant, lying scattered everywhere on the surface of the reef in a few inches of water only, that their share here in the reef-formation must be no inconsiderable one. The closely-set vertical plates of the *Pavonia* are better adapted than any other for catching and holding the various débris of which the bulk of every coral-reef is composed. The *Pocilloporas* are abundant, but are not here, as at Hawai, the leading and principal form."[1]

The following eleven species are new :—

Pocillopora solida.
Fungia rugosa.
Sandalolitha dentata.
Domoseris porosa.
„ *solida.*
Domoseris regularis.
Cylloseris incrustans.
Madrepora speciosa.
„ *parilis.*
Porites latistellata.
Napopora irregularis.

Of these, four species, *Sandalolitha dentata*, *Domoseris porosa*, *Cylloseris incrustans*, and *Napopora irregularis*, are types of new genera.

The following nineteen species are recorded for the first time from Tahiti :—

[1] Moseley, MS. Diary.

Pocillopora cespitosa.
Leptastræa roissyana.
„ *ehrenbergana.*
„ *transversa.*
„ *solida.*
Fungia horrida.
„ *acutidens.*
„ *concinna.*
Pachyseris speciosa.
Trochoseris stokesi.
Madrepora retusa.
„ *plantaginea.*
„ *virgata.*
„ *laxa.*
Montipora aspera.
„ *papillosa.*
Porites arenosa.
Millepora nodosa.
Millepora gonagra.

The list of the Reef-Corals now known to occur in the Society Islands, includes the following fifty-five species :—

Pocillopora cespitosa, Dana.
„ *suffruticosa*, Verrill.
„ *grandis*, Dana.
„ *squarrosa*, Dana.
„ *solida*, n. sp.
Mussa costata, Dana.
„ *cytherea*, Dana.
Plesiastræa coronata, Dana.
Leptastræa roissyana, Edw. and H.
„ *ehrenbergana*, Edw. and H.
„ *transversa*, Klz.
„ *solida*, Edw. and H.
Fungia horrida, Dana.
„ *discus*, Dana.
„ *acutidens*, Studer.
„ *concinna*, Verrill.
„ *scutaria*, Lamk.
„ *paumotensis*, Stutchb.
„ *tenuifolia*, Dana.
„ *rugosa*, n. sp.
Sandalolitha dentata, n. sp.
Herpetolitha stricta, Dana.
Pavonia formosa, Dana.
„ *prætorta*, Dana.
Phyllastræa explanata, Verrill.
Domoseris porosa, n. sp.
„ *solida*, n. sp.
„ *regularis*, n. sp.
Cylloseris incrustans, n. sp.
Trochoseris stokesi, Edw. and H.
Dendrophyllia radiata, Verrill.
Madrepora retusa, Dana.
„ *danæ*, Verrill.
„ *plantaginea*, Lamk.
„ *virgata*, Dana.
„ *nasuta*, Dana.
„ *paxilligera*, Dana.
„ *speciosa*, n. sp.
„ *cytherea*, Dana.
„ *surculosa*, Dana.
„ *turbinata*, Dana.
„ *globiceps*, Dana.
„ *cuspidata*, Dana.
„ *hebes*, Dana (?).
„ *tubicinaria*, Dana (?).
„ *laxa*, Lamk.
„ *parilis*, n. sp.
Montipora lichen, Dana.
„ *effusa*, Dana.
„ *aspera*, Verrill.

Montipora papillosa, Lamk.
Synaræa convexa, Verrill.
,, *solida*, Verrill.
Porites arenosa, Esper.
Porites latistellata, n. sp.
Napopora irregularis, n. sp.
Millepora nodosa, Esper.
,, *gonagra*, Edw. and H.
Millepora incrassata, Dana.

GENERAL RESULTS OF DISTRIBUTION.

Tabular view of the number of Genera and Species obtained, with their Localities.

ATLANTIC.

Locality.	Number of Species obtained.	Number of Genera represented.	Number of New Species.	Number of New Genera.
St. Thomas, West Indies,	15	9	1	...
Bermuda,	25	10	1	...
St. Vincent, Cape Verde,	3	2	...	...
Barra Grande, Brazil,	1	1	...	...
Simon's Bay, Cape of Good Hope,	1	1	...	...

PACIFIC.

Tongatabu,	10	9	...	...
Fiji Islands,	60	30	15	1
Api, New Hebrides,	10	7	4	...
Australia,	17	10	4	1
Banda,	36	21	10	1
Amboina,	26	19	7	...
Arafura Sea,	1	1	...	...
Ternate,	12	9	5	...
Mactan Islands,	19	13	3	...
Samboangan,	44	17	14	1
Honolulu,	12	4	1	...
Tahiti,	42	15	11	4

Thus from the above table it will be seen that extremely interesting results were obtained from nearly all the Stations at which Corals were collected; while from the standpoint of the variety and rarity of the forms included, special mention must be made of the Tahiti and Banda collections. The most remarkable form, however, which was collected, *Moseleya latistellata*, was dredged off Wednesday Island, Australia.

DISTRIBUTIONAL AREAS.

A sharp line of demarcation apparently separates the Reef-Coral fauna of the Atlantic on the one hand and the Pacific and Indian Oceans on the other (with the doubtful exception of *Isophyllia australis*, which has been recorded from both regions by Milne-Edwards and Haime, Cor., ii. p. 375); though from the occurrence of *Manicina areolata* in 20 fathoms water in Simon's Bay, Cape of Good Hope, it may be doubted whether the two areas will prove to be so sharply defined.

In the Atlantic, no definite districts can be made out, the fauna throughout being essentially West Indian.

In the Pacific and Indian Oceans, the fauna is characterised generally by more or less uniformity, exception being made, however, in the cases of the districts of the Sandwich Islands and the West Coast of America, each of which appears to be more or less markedly circumscribed by the distinctness of the forms which flourish there.

The Reef-Corals of Tahiti are similar in many respects to the Corals of the Red Sea, many species being common to both; while almost the same may be said of the Corals of the Friendly Islands, the Fiji Islands, and the Philippines.

It must be confessed, however, that any attempt to generalise from the facts at hand, as to the relation of the fauna of the chief centres of coral growth in the Pacific and Indian Oceans, must be at least premature, and this owing to several causes.

In the first place, for a large number of the species which have been described, more especially by the old authors, no definite locality is recorded; the locality being either altogether omitted or given under such vague terms as, "Indian Ocean," "East Indies," "Austral Seas," "Australasia," &c.

In the second place, of the large collection of Corals in different museums but little is really known, owing to the want of published detailed reports or catalogues of the collections.

And in the third place, while several voyages and expeditions have been accomplished through many parts of the coral regions during which collections have been made with more or less interesting results, yet no prolonged and exhaustive examination of the genera and species of Reef-Corals found in any one locality, excepting in the Red Sea, has yet been made by any practised naturalist; so that our knowledge of the distribution of the Reef-Corals throughout the multitudinous islands and formations of the Indian and Pacific Oceans is, at the best, fragmentary and unreliable.

It is a welcome sign, however, of the impetus which recent research has given to the study of the Anthozoa, that two practised naturalists are carrying on investigations into the fauna of certain districts of the Indian and Indo-Pacific Oceans and it cannot be doubted that extremely interesting additions will be made therefrom to our knowledge of the Corals of these regions.

BATHYMETRICAL LIMITS TO DISTRIBUTION.

It has usually been considered that the growth of Reef-Corals is limited to depths of from 1 to 30 fathoms. This conclusion has been much shaken in recent years, and the light thrown upon the question by species obtained by the Challenger, tends to show that the depth limits will have to be extended.

Five species were obtained from depths ranging to more than 30 fathoms.

Trochoseris stokesi,	30 to 70 fathoms.
Domoseris regularis,	30 to 70 fathoms.
Porites lichen,	1 to 40 fathoms.
Montipora capitata,	1 to 40 fathoms.
Pocillopora nobilis,	10 to 40 fathoms.

And while it may be doubted whether the two former species play any considerable part in reef-formation, it must be acknowledged that the three latter are definite reef-builders. It seems tolerably certain, however, that the zone of most active growth is confined to comparatively shallow waters, at depths of 1 to 20 fathoms.

THERMAL LIMITS TO DISTRIBUTION.

An interesting fact in relation to this question has been brought to light by the Challenger—namely, that a specimen of an undoubted reef-building species, *Manicina areolata*, was obtained in Simon's Bay, Cape of Good Hope, between lat. 34° and 35° S., at a depth of 10 to 20 fathoms, the temperature at that depth being 65° (Challenger observations). The thermal limit of 68°, which has usually been considered the lowest temperature limit to regulate the distribution of reef-building forms, may still be held to be the extreme limit for reef-formation, which results from the luxuriant growth of the reef-building species. It is evident, however, that these species, independently of reef-formation, may have a wider range. In this relation special reference must be made to the fact of the occurrence of a species of *Madrepora*, *Madrepora borealis*, Edw. and H. (Milne-Edwards and Haime, Cor., iii. p. 144), in the cold waters of the White Sea, near Archangel, the type specimen of which, collected by Mons. Eugéne Robert in 1829, I have seen in the Paris Museum, and which has since been examined again for me by Mons. Poirier of the Paris Museum; a fact which is the more remarkable in that the species of *Madrepora*, with this exception, are characteristic of the warmest waters of the reef regions. It seems to me that considering the thermal conditions under which these two species, *Manicina areolata* and *Madrepora borealis*, are known to have developed, we are on the threshold of the knowledge as to the distribution in place of those forms which, in the warmer tropical waters, are confined to within comparatively narrow limits as reef-builders.

The occurrence of such a characteristic West Indian Reef-Coral as *Manicina areolata*

within a few miles of the southernmost extremity of the African mainland is the more remarkable when the distinctness of the Atlantic and the Indian and Pacific reef fauna is borne in mind. It seems probable that when our knowledge of the distribution of the reef species is more extended, it will be found that many species are common to these apparently distinct regions; the path of communication being that indicated by the *Manicina areolata*, round the southern extremity of Africa. The thermal barrier can scarcely be considered a difficulty in the way, since the eastern and western shores of the mainland at this point are bathed by the warm waters of the Mozambique and South Atlantic currents respectively. In this connection it is extremely desirable to have a thorough and accurate examination of the species of Corals on the coasts of Natal.

Milne-Edwards and Haime (Cor., ii. p. 137) have recorded the Pacific and Indian Ocean species *Stylophora palmata* from the Cape of Good Hope, but it may be doubted whether this term was not used in its more general sense, The Cape, that is, signifying Cape Colony. If the species be found actually at the Cape of Good Hope, we have at least one species which is known to be common to the Atlantic and the Indian and Pacific reef regions.

PECULIAR CASES OF DISTRIBUTION.

Under this head, brief reference is made to some of the more peculiar conditions under which certain species of Corals are known to exist, one case of which the Challenger furnishes.

1. Generally speaking the presence of fresh or brackish water is sufficient to prevent all coral growth; *Cylicia rubeola*, Quoy and Gaimard, however, flourishes in the River Thames, New Zealand, and *Madrepora cribripora*, Dana, inhabits nearly fresh water.

2. Muddy water is equally destructive to coral growth, yet *Porites limosa*, Dana, flourishes under such conditions, while *Astræa bowerbanki*, Edw. and H., as recorded by the Rev. J. E. Tenison-Woods, does not seem to mind mud or sediment, or even muddy brackish water; it grows incrusting a large proportion of the stones at the mouth of the Mangrove Creek, Australia, all these stones being covered with mud and slime, and washed over, twice in the twenty-four hours, by muddy, brackish water.

3. The extreme saltness and density of the waters of the Dead Sea might have been thought sufficiently unfavourable for the development of coral life, but *Stylophora pistillata*, Esper, a common Red Sea species, is recorded from this locality by Milne-Edwards and Haime.

4. Exposure at low tide is generally destructive to coral life, but at Banda, as observed by Professor Moseley, an Astræan which was thus exposed appeared to suffer no more in consequence than do the common sea-anemones of our own coasts (see quotation under "Banda Corals"), while Dana records that species of *Porites* and *Siderastræa* left exposed at low tide, do not appear to suffer from the effects of sunshine and rain while thus exposed.

CLASSIFICATION.

The classification here proposed for the Sclerodermic Zoantharia or Madreporaria is, in the main, based on the system of Milne-Edwards and Haime, as developed in the Histoire Naturelle des Coralliaires. This system, owing to the researches of numerous investigators within the last few years, has been considerably altered, and the changes necessitated have been very recently (August 1884) given expression to by Professor P. Martin Duncan in his valuable and much needed Revision of the Families and Genera of the Sclerodermic Zoantharia, from which revision unfortunately the Madreporaria Rugosa were excluded.

While acknowledging my extreme indebtedness to this work, among others, of Professor Duncan, I must at the same time state that the examination of the Reef-Corals of the Challenger, and their comparison with recent and fossil forms, have thrown much new light upon classification, and have led to the modification of his scheme in many not unimportant particulars, chief among which may be mentioned the treatment of the section Madreporaria Rugosa, which here has been merged into that of the Madreporaria Aporosa.

The more immediate cause which has led to this change has been the structure and relationship of the remarkable Coral *Moseleya latistellata*, which was dredged by the Challenger in 8 fathoms water off Wednesday Island, Torres Straits, Australia, and for which a new subfamily, Moseleyinæ, of the Astræidæ, was provisionally proposed,[1] while its close affinity with the Rugosa and the probable dismemberment of that group were at the same time indicated. This form has now been definitely placed under the family Cyathophyllidæ.

The opinion of Louis Agassiz that the Rugosa should be referred to the Hydrozoa rather than to the Anthozoa, has not been justified; while, on the other hand, the tendency of more recent investigation and thought has been to show that, although many of the forms generally referred to the Rugosa are probably not Madreporarian, yet the essential characteristics of the more typical forms are decidedly those of the Zoantharia Sclerodermata. This opinion on the classification of the Rugosa has been most recently endorsed by Professor Duncan, who groups them under the Zoantharia Sclerodermata or

[1] *Ann. and Mag. Nat. Hist.*, 1884, vol. xiii. p. 293.

Madreporaria, while he cautiously states that "probably most of its genera are not Madreporarian."[1]

In the following classification the Madreporaria are primarily divided into three sections.

Section I. Madreporaria Aporosa (=Madreporaria Aporosa and Madreporaria Rugosa, Auctt).
„ II. Madreporaria Fungida.
„ III. Madreporaria Perforata.

Section I. MADREPORARIA APOROSA.

The definition of this section, as limited by Professor Duncan,[2] needs but one slight alteration in the characters of the septa to make it applicable to the section, as extended above, to include the old Madreporaria Rugosa. The septa may be distinctly lamellate, and solid or cribriform, or indistinctly lamellate, becoming more or less vesicular.

Professor Duncan also observes that "the hexameral arrangement of the septa is not constant; it may be pentameral, heptameral, octameral, or decameral."[3] To this should have been added that it may also be tetrameral.[4]

The group Madreporaria Aporosa, as now extended, is defined as follows:—

Madreporaria with simple or colonial forms. Hard structures usually solid and imperforate. Theca or wall solid, may be epithecate. Arrangement of the septa variable. Septa distinctly lamellate, and solid or cribriform, or indistinctly lamellate, becoming more or less vesiculate. Interseptal loculi open throughout, or closed more or less by endotheca in the form of dissepiments, tabulæ, and stereoplasm. Calicles of different shapes.

This section is divided into three subsections, each of which is again divided into families.

Subsection I. Turbinolida.
„ II. Oculinida.
„ III. Astræida.

Subsection I. TURBINOLIDA.

This subsection is not treated of in the present Report, but is characterised as follows:—Corallum simple or in colonies without exotheca. Septal loculi open to the base.

[1] *Journ. Linn. Soc.* (Zool.), vol. xviii. p. 6.
[2] Revision, p. 7.
[3] Revision, p. 7.
[4] Vide *Holocystis*, Revision, p. 130.

Family I. Turbinolidæ.
Genera *Desmophyllum, Flabellum,* &c.

Family II. Cyathaxonidæ.
Genera *Cyathaxonia, Guynia, Duncania, Haplophyllia.*[1]

Family III. Dasmidæ.
Genus *Dasmia.*

Subsection II. OCULINIDA.

This subsection is characterised as follows :—

Colonial Madreporaria Aporosa in which the interseptal loculi are usually open to the base, but sometimes with dissepiments or tabulæ. Internal space diminishing on account of the growth of stereoplasm. Solid intercalicular cœnenchyma usually well developed.

Family I. Oculinidæ.
,, II. Pocilloporidæ.

These families are taken as defined by Professor Duncan,[2] but it seems to me very doubtful whether they will prove to be really distinct.

Subsection III. ASTRÆIDA.

This section is characterised as simple or colonial Madreporaria Aporosa, in which the interseptal loculi contain dissepimental endothecæ, or are more or less replaced by vesiculate endothecæ, with or without tabulæ, and in which solid intermural cœnenchyma is rarely developed.

Family I. Astræidæ.
,, II. Cyathophyllidæ.
,, III. Stauridæ.
,, IV. Cystiphyllidæ.

These families are accepted much according to their ordinary definition, the differences from which, in each case, will be briefly denoted.

The Cystiphyllidæ form a fairly natural and distinct family, as is acknowledged, I believe, by all authorities. Its very decided relationship to the Cyathophyllidæ, on the

[1] For Remarks on the Fossula, see Subsection III., Astræida.
[2] Revision, pp. 36, 46.

one hand, however, is clearly marked, since in many genera of the latter the condition of the septa, especially at their extreme peripheral portion, is closely similar to that which is normal throughout the whole internal structure of the Cystiphyllidæ; while on the other hand doubtful representatives of the family present distinctly Alcyonarian features in their opercular characters.

The Stauridæ, among which is included the genus *Holocystis*, which has been placed by Professor Duncan in the Astræidæ, in their typical form differ from the more typical of the Astræidæ, as here limited, simply in the distinctly tetrameral arrangement of their septa. Very little value can be given to the absence of a columella or of costæ in *Stauria*, for not only are these structures well developed in the genus *Holocystis*, but they are among the characters of Astræida some of the most variable in development. A variability in the distinctness of the tetrameral arrangement of the septa, even in the Stauridæ, however, is clearly indicated in *Metriophyllum*, where, instead of the distinct and strong Maltese cross characteristic of *Stauria*, are found the four bundles of septa which present a transitional character between this family and the Cyathophyllidæ, a transitional character originally pointed out by Milne-Edwards and Haime (Cor., iii. p. 328).

It is difficult to draw any clear line of demarcation between the families Astræidæ and Cyathophyllidæ, the more especially that certain genera of the one are clearly related to genera of the other possessing nearly identical characteristics. The usually accepted grouping of the two families seems to be based more essentially on their distribution in time than on any constant structural characteristics of real classificatory value. With a view more perfectly to grasp the essential characteristics tending on the one hand to relate and on the other to separate them, it will be instructive to examine, if only briefly, the main features which are supposed so to distinguish the forms commonly known as the Rugosa as to entitle them to the rank of a distinct order or suborder.

While confessedly, in its most essential respects, the corallum of a typical Rugose Coral is quite identical with that of a typical Aporose Madreporian, it has been contended that the following more striking points of difference in the Rugose Coral are sufficient to give it ordinal or subordinal rank.

1. The septa appear to be primitively developed in four systems instead of six.
2. The septa are rendered more or less irregular in their arrangement by the presence of a curious vacant space (sometimes three or four), which is known as the fossula, and which appears to take the place of one of the primitive four septa.
3. When the septa are well developed, they generally present themselves in the adult as of two sizes only, a larger and a smaller.
4. Tabulæ are usually present, in conjunction with the septa.

5. The compound coralla possess no true cœnenchyma, and one of their commonest modes of increase is by means of calicular gemmation.

As regards the first point, it must be remembered that modern investigation gives a constantly declining value to any essential difference between a tetrameral and hexameral arrangement of the septa. In many Astræids, not only is it an impossibility in the adult forms to prove the predominance of six septa, but also to derive the number present from such a type; for the total number present of those that are well developed is often not a multiple of six. And while in such a form as *Stauria* we are confronted with a distinctly marked cruciate arrangement, it is necessary to bear in mind that the transitional forms between the Stauridæ and the Cyathophyllidæ shew a decided decrease in the distinctness of such an arrangement, until in many species of typical Cyathophyllidæ, as in species of *Cyathophyllum*, *Lithostrotion*, *Acervularia*, &c., we arrive at a condition in which the septa are simply radially arranged without any indication whatever of a tetrameral type.

As regards the second point, the presence or absence of a fossula is essentially a matter of but slight importance, and at most is recognised to be but of generic value, the genera which possess and those which do not possess a fossula being grouped together in the same tribe or subfamily, while to take a more especial case, as in the genus *Cyathophyllum*, in which a small septal fossula is often present, species which possess and those which do not possess this fossula are grouped under the same genus, the character in this case being recognised as not even possessing generic value.

As regards the third point, it must be claimed that the presence of but two sizes of septa is as characteristic of a large number of the most typical Astræids (species of *Orbicella*, *Prionastræa*, &c.), as it is of the Rugose Coral. On the other hand, in the most typical of the Rugosa, in which the tetrameral arrangement is most visible, as for instance in *Stauria*, the septa are markedly of very different sizes according to the cycle to which they belong; a condition seen most clearly in a transverse section of the corallum, not only in *Stauria* but in many species of the Cyathophyllidæ, where by the union of the smaller septa with the larger, a clear idea of their inequality can be gained by the extremely variable position of their point of coalescence and its distance from the centre of the calicle. In *Strombodes* (as in *Strombodes murchisoni*) the extremely variable size of the septa is a most marked character; in species of *Endophyllum* the variability among themselves of the smaller and larger septa is distinctly seen; while in many species of *Cyathophyllum* (*Cyathophyllum stutchburyi*, *Cyathophyllum regium*, *Cyathophyllum rugosum*, *Cyathophyllum marmini*, &c.) where roughly it may be stated that the septa are alternately equal, a transverse section sohws that there is a variability in the exact length not only of the shorter septa, but also of the larger which approach the centre, for while certain of them do actually reach there, many as certainly stop short of it. It seems to me that if transverse sections of typical Astræids be taken for comparison,

very little value can be given to the character that the septa of the Rugosa are generally of two sizes.

As regards the fourth point, it must be conceded that tabulæ are more characteristic of the Rugosa as a whole than they are of the Astræids, though exceptions occur on both sides; for while there are Rugosa which are destitute of tabulæ, there are also Astræids which possess them. It is moreover a very doubtful point as to what value should be placed on the presence or absence of these structures, considering the high degree of development to which they attain in other and widely distinct Aporose Madreporaria.

As regards the fifth and last point, it must be stated that the absence of a true cœnenchyma in the compound coralla, and the increase by calicular gemmation are as sharply characteristic of some of the most highly developed of the Astræids (as for instance, the forms of the genus *Prionastræa*) as of the Rugosa.

Thus, as the result of the foregoing considerations, there is not a single characteristic of the old group Rugosa which will essentially separate its forms from the more typical Astræids; and a direct expression is given to this fact by placing the families of the old Rugosa (except the family Cyathaxonidæ, which has been placed under the subsection Turbinolida) with the family Astræidæ, under the subsection Astræida.

An extremely interesting comparison of a typical recent Astræid with a Cyathophyllid may be made by selecting specimens of *Prionastræa favosa* (=*Madrepora favosa*, Ell. and Sol.) and the compound form of *Cyathophyllum helianthoides*, Goldf. In the former the calicles are large, being about 30 mm. in diameter, and deep, about 10 to 15 mm; the walls are simple, and excessively thin above, and in transverse section are seen to be very slightly developed and vesiculate; the septa are numerous, often about 48, and subequal, projecting nearly evenly to the centre, where their innermost teeth give rise to a false columella; and the dissepiments are very abundant, oblique and vesiculate. In *Cyathophyllum helianthoides* the foregoing characters are almost identical, but the dissepiments are placed higher, leaving but a small extent of septa free exteriorly, and at the centre give place or give rise to slightly developed tabulæ.

This comparison, indeed, brings to light not only the essential relation between the two types, and the close affinities of the families to which they belong, but points to the most constant difference which will serve to distinguish the Astræidæ and the Cyathophyllidæ, while the generally prevailing hexameral arrangement of the septa in the former will serve still further to limit them—characters in both cases, it must be confessed, of doubtful value.

The relation of the form *Moseleya latistellata* to the Astræidæ, as exemplified in *Prionastræa favosa*, Ell. and Sol., is equally striking and suggestive. In *Moseleya latistellata* the calicles are as large as or larger than those of *Prionastræa favosa;* the septa are much more numerous, markedly of unequal sizes, often continuous from calicle to calicle, and give no indication of hexameral arrangement, while in a simple young form,

which has budded from the surface of a large and partially dead basal calicle, from which also the chief mass of the colony has developed, a tetrameral arrangement is distinctly visible owing to a cruciate arrangement of four larger septa; the wall is simple, extremely thin, and very slightly and irregularly developed; the innermost terminations of the septa exteriorly give rise to a false columella, the larger septa lower down meeting quite at a point; the dissepiments are extremely abundant and vesiculate, coming high up so as to leave but a very small part of the septa free exteriorly, except at the centre, where a distinctly marked depression is visible; these dissepiments, in transverse section, are seen to be more or less distinctly arranged in concentric circles, especially towards the centre where, in the single specimen of the species which was obtained, two distinct nearly solid, sub-infundibuliform tabulæ are present, which seem to take their origin from the concentration and coalescence of the dissepiments, and in which the course of the larger septa is clearly visible.

From the consideration of this form, *Moseleya latistellata*, and its comparison on the one hand with a typical Astræid like *Prionastræa favosa*, and on the other hand with a Cyathophyllid like the compound form of *Cyathophyllum helianthoides*, or like *Cyathophyllum regium*, it results that the essential difference from the Astræid, and the essential similarity to the Cyathophyllid, is to be found in the abundant development of vesiculate endotheca coming high up in the calicle so as to leave a very small portion of the septa free exteriorly, except at the centre of the fossa, the dissepiments towards the centre being arranged in more or less concentric circles, giving rise to or replaced by tabulæ in which the course of the septa is traceable: characters which are, with but slight modifications, the distinguishing features of forms of the family Cyathophyllidæ.

Section II. MADREPORARIA FUNGIDA.

This section is taken as defined by Professor Duncan,[1] by whom it is divided into the following five families.

Family I. Plesiofungidæ.
„ II. Lophoseridæ.
„ III. Fungidæ.
„ IV. Anabaciadæ.
„ V. Plesioporitidæ.

Of these the first three are represented in the collection.

[1] Revision, p. 132.

Family I. Plesiofungidæ.

The family Plesiofungidæ has been founded by Professor Duncan to include many forms which modern investigation has shown to be more or less transitional between the Aporosa and the Fungida. As characterised by the presence of endothecal dissepiments as well as of synapticulæ, it includes many of the genera which have been referred to the Lophoseridæ, as for instance, *Tichoseris* (in the preliminary notice of which no dissepiments were described), *Pavonia* (=*Lophoseris*, Edw. and H.) in the thick and more massive species of which true dissepiments are well developed and were described by Verrill,[1] and *Agaricia*. In many genera which are closely related to the foregoing, and in which generally the species are thin and explanate, no dissepiments have been described; but observations are wanting on many of the forms.

Family II. Cycloseridæ.

The family Cycloseridæ [=Lophoseridæ (pars), Duncan] includes those Fungida in which the wall is solid, and neither perforated nor echinulate, and in which there are no dissepiments. The family name is taken from the most typical genus of the group, *Cycloseris*, and is thus directly comparable to the family name Fungidæ, which has been derived from the typical genus *Fungia*. As the genera *Pavonia* (=*Lophoseris*, Edw. and H.) and *Agaricia* now take their place among the Plesiofungidæ, the terms Pavonidæ, Lophoseridæ, and Agaricidæ are not available for this family.

Family III. Fungidæ.

It is interesting to observe that though in the adult forms of the most typical genus of this family the wall is perforated, yet in the young stages it is frequently almost solid and imperforate.

Section III. MADREPORARIA PERFORATA.

This section is taken as defined by Professor Duncan.[2] It includes three families, all of which are represented in the collection.

Family I. Eupsammidæ.
„ II. Madreporidæ.
„ III. Poritidæ.

Following Mr. S. O. Ridley,[3] I have placed the genera *Montipora* and *Anacropora* in the family Madreporidæ. It must be acknowledged, however, that the families Poritidæ and Madreporidæ are separated by but slight characters.

[1] *Trans. Connect. Acad.*, vol. i. p. 542. [2] Revision, p. 172. [3] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xiii. p. 278.

TABULAR VIEW OF THE FAMILIES AND GENERA REPRESENTED IN THE COLLECTION.

MADREPORARIA.

Section I. MADREPORARIA APOROSA.

Subsection I. OCULINIDA.

Family Oculinidæ.

Genus 1. *Oculina.*
„ 2. *Acrohelia.*
„ 3. *Amphihelia.*
Genus 4. *Madracis.*
„ 5. *Stylophora.*

Family Pocilloporidæ.

Genus 1. *Seriatopora.*
Genus 2. *Pocillopora.*

Subsection II. ASTRÆIDA.

Family Astræidæ.

Genus 1. *Cladocora.*
„ 2. *Galaxea.*
„ 3. *Caulastræa.*
„ 4. *Euphyllia.*
„ 5. *Physogyra.*
„ 6. *Pectinia.*
„ 7. *Trachyphyllia.*
„ 8. *Mussa.*
„ 9. *Symphyllia.*
„ 10. *Isophyllia.*
„ 11. *Ulophyllia.*
„ 12. *Tridacophyllia.*
„ 13. *Diploria.*
„ 14. *Manicina.*
Genus 15. *Mæandrina.*
„ 16. *Cœloria.*
„ 17. *Hydnophora.*
„ 18. *Astræa.*
„ 19. *Goniastræa.*
„ 20. *Acanthastræa.*
„ 21. *Prionastræa.*
„ 22. *Plesiastræa.*
„ 23. *Phymastræa.*
„ 24. *Orbicella.*
„ 25. *Cyphastræa.*
„ 26. *Leptastræa.*
„ 27. *Merulina.*

Family Cyathophyllidæ.

Genus *Moseleya.*

Section II. MADREPORARIA FUNGIDA.

Family Plesiofungidæ.

Genus 1. *Siderastræa.*
„ 2. *Tichoseris.*
Genus 3. *Pavonia.*
„ 4. *Agaricia.*

Family Cycloseridæ.

Genus 1. *Cycloseris.*
„ 2. *Trochoseris.*
„ 3. *Pachyseris.*
„ 4. *Cylloseris.*
Genus 5. *Domoseris.*
„ 6. *Psammocora.*
„ 7. *Stephanaria.*
„ 8. *Oxypora.*

Family Fungidæ.

Genus 1. *Fungia.*
„ 2. *Halomitra.*
„ 3. *Podabacia.*
„ 4. *Cryptabacia.*
Genus 5. *Lithactinia.*
„ 6. *Herpetolitha.*
„ 7. *Sandalolitha.*

Section III. MADREPORARIA PERFORATA.

Family Eupsammidæ.

Genus 1. *Rhodopsammia.*
Genus 2. *Dendrophyllia.*

Family Madreporidæ.

Genus 1. *Madrepora.*
„ 2. *Turbinaria.*
„ 3. *Astreopora.*
Genus 4. *Anacropora.*
„ 5. *Montipora.*

Family Poritidæ.

Genus 1. *Porites.*
„ 2. *Napopora.*
„ 3. *Synaræa.*
„ 4. *Goniopora.*
Genus 5. *Rhodaræa.*
„ 6. *Tichopora.*
„ 7. *Alveopora.*

HYDROCORALLINÆ.

Family Milleporidæ.

Genus *Millepora.*

DESCRIPTIONS OF GENERA AND SPECIES.

Section MADREPORARIA APOROSA.

Subsection OCULINIDA.

Family Oculinidæ.

Genus 1. *Oculina*, Lamarck.

Oculina, (pars), Lamarck, Hist. Anim. sans Vert., ii. p. 283, 1816.
„ Milne-Edwards and Haime, Cor. (Hist. Nat.), ii. p. 105.
„ Duncan, Revision (Madreporaria), p. 41.

Seven species of this genus are represented.

1. *Oculina diffusa*, Lamarck.

Oculina diffusa, Lamarck, Hist. Anim. sans Vert., ii. p. 285, 1816.
„ „ Milne-Edwards and Haime, Cor., ii. p. 107.

A very fine large specimen and many small much branched pieces were obtained. The small pieces, which were from Bermuda, have the surface scarcely granulated, while the branches are very shortly divided and much thickened; the branchlets are subequal in thickness throughout, and closely crowded with calicles at their extremities, owing to the clustered incipient branchlets.

The large specimen from St. Thomas presents some interesting features, differing considerably from the Bermuda specimens; but on comparison with a large series of the species, it is impossible to separate it by any fairly constant character. This specimen consists of a closely crowded and densely branched tuft, very coalescent below, with numerous, nearly straight, upright branchlets above, which are often 3 cm. long. The extremities are not clustered with incipient branchlets nor crowded with closely placed calicles. New branchlets, with rare exceptions, originate, not at the extreme apex of the branches, but laterally from numerous buds on different parts of the corallum, chiefly on the basal parts of the smaller branchlets. The calicles on the apical parts are 3 to 4 mm. in diameter, regularly oval, rather distant and prominent, with well-marked

rather deep interspaces; and the calicular margin is thickened and neatly rounded. The surface is very strongly granulated.

Localities.—St. Thomas, shallow water; Bermuda.

2. *Oculina pallens*, Ehrenberg.

Oculina pallens, Ehrenberg, Cor. roth. Meer., p. 79.
„ „ . Dana, Zoophytes, p. 395.

As pointed out by Pourtalès, the species is distinct from *Oculina diffusa*, of which Milne-Edwards and Haime had supposed it a synonym; it is, however, closely allied to that species. The specimen obtained consists of a loosely ramose corallum about 30 cm. high, with long spreading branches somewhat attenuated at the extremity, and sparsely coalescent. Ehrenberg gives the width of the calicles as $1\frac{1}{2}$ lines and Dana as $1\frac{1}{4}$, but this would seem to vary very much at different parts of the corallum. On the thick branches the calicles are circular and about 3 to 3·5 mm. wide, while on the branchlets and apical parts they become oblique and are longer and narrower, the long diameter being often as much as 4 mm. The septa are very uneven and exsert; the primaries and secondaries very strong and wide and project far towards the centre of the calicle, the pali being scarcely distinct paliform teeth which are often very small, especially in the apical oblique calicles where the septa become more exsert, and like the costæ curve towards the distal part of the branches. In these apical calicles, the septa towards the distal parts are very markedly longer and inclined.

The drawings of the calicles on pl. iii. fig. 17, in the Report on the Florida Reefs[1] are fairly good, but figs. 14 and 15 are misleading, owing to the indistinctness of the essential structure of the calicles. In these drawings the septa should be prolonged almost to the centre, with very small and thin pali; while in the oval calicle the distal septa should be enlarged, elongated and curved.

The deeper, less prominent calicles which are oblique at the distal parts, the very exsert and large septa, and the slightly developed pali apparently separate this species from the *Oculina varicosa*, to which it is, however, very closely allied.

Locality.—Bermuda.

3. *Oculina varicosa*, Lesueur.

Oculina varicosa, Lesueur, Mém. du Mus., vi. p. 291, pl. xvii. fig. 19.
„ „ Dana, Zoophytes, p. 394.

Four specimens of this species were obtained, three of which are very large, with extremely elongated branchlets, sometimes more than 30 cm. long. The calicles are 3 to 4

[1] Agassiz, *Mem. Mus. Comp. Zoöl.*, Cambridge, U.S.A., vol. vii. No. 1.

mm. wide, not deep, often shallow, close in the same spiral line, and generally very prominent, especially at the basal parts of the branches, where they are about 4 to 8 mm. above the general surface. They are circular, with the sides nearly at right angles to the general surface, but towards the proximal parts the bases of the calicles are swollen in such a manner as to form a concavity from the edge of the calicle to the general surface of the corallum. The calicular fossa is moderately deep in the very prominent calicles, but shallow in the others. The costæ are very distinct, long and curved; the septa are exsert, rather thick and subequal, the primaries being a little thicker and longer than the secondaries or tertiaries; the pali are well-developed but rather thin, and arranged as in *Oculina speciosa*, often nearly filling up the calicular fossa, the secondaries being larger than the primaries and forming an outer circle; columella generally well developed.

As pointed out by Verrill and Pourtalès, this species is distinct from *Oculina diffusa*, of which Milne-Edwards and Haime had supposed it a synonym. It is also quite different from *Oculina petiveri*, which Pourtalès had supposed to be its synonym. From the following additional characters of the *Oculina petiveri*, it will be seen how distinct it is from the present species: the costæ are scarcely marked and short; the bases of the calicles are much swollen, but broad rather than high, so that a distinct convexity is formed from the edge of the calicle to the general surface; the septa are very thin, not exsert, and project but very slightly at their upper portion towards the centre of the calicle; the pali are extremely thin and are simply the inner prolongations of the septa, being not at all distinct from these nor from the columella.

The *Oculina varicosa* is very close to the *Oculina virginea*, Lamarck, from the Indian Ocean (?), the specimen of which from the collection of Lamarck is in the Paris Museum; and, indeed, it may be oubted whether they are specifically distinct. The only character that apparently separates them is the degree of prominence of the calicles, especially of those on the basal parts of the branches. In the *Oculina varicosa* the prominence increases from the distal to the proximal part of the axis, becoming very great at the base, while in *Oculina virginea* they are usually less prominent at the basal parts than at the middle of the branches, being about 2 mm. above the general surface.

Very good figures of the species are given in the Report on the Florida Reefs, in which pl. ii. shows the characteristic form, while pl. i. represents the variety with scarcely prominent calicles: magnified views of the calicles showing their essential structure are given in pl. ii. fig. 4 and pl. iii. figs. 8, 9.

Localities.—Bermuda; St. Thomas.

4. *Oculina coronalis*, n. sp. (Pl. I. figs. 6–6c).

Corallum arborescent, large, very much branched, 10 to 14 mm. thick below, becoming very attenuated above; branches and branchlets about 2 to 10 cm. long, often

divaricate and contorted, close or spreading in all directions, seldom coalescent. Calicles deep, raised about 0·75 to 1·5 mm., rarely depressed, generally somewhat swollen at the base, uniformly circular except at the very extremity of the branchlets where they become slightly oval, placed irregularly at unequal distances apart, not infrequently in vertical lines, small especially on the branchlets, about 2 to 3 mm. in diameter. Costæ scarcely distinct except near the calicles, curved. Septa in three cycles, a little exsert, very granulated, thickened outside, their inner free edge vertical and scarcely projecting from the wall, and joining the pali low down in the cup, being separated from them by a very deep notch; the primaries thicker and more projecting than the secondaries, and these slightly more so than the tertiaries. Pali twelve, a little unequal, well developed, more so than in *Oculina speciosa*, wide and very thick, closely arranged in a circle and very distinctly bunch-like and apparently isolated in the cavity of the calicle, the secondaries being often more elevated than the primaries, but never so as to give a shallow appearance to the fossa. Columella well developed and consisting of rounded and thick papillæ.

The very numerous, long, crowded branches and branchlets spreading in all directions; the deep, rather prominent, small, circular calicles; the faint costæ; the narrow vertical septa; and the specially developed bunch-like group of pali forming a marked crown, will distinguish this from all other species. It is near the *Oculina speciosa*, but differs markedly in the characters of its calicles.

Locality.—Bermuda.

5. *Oculina speciosa*, Milne-Edwards and Haime.

Oculina speciosa, Milne-Edwards and Haime, Cor., ii. p. 106.

This specimen consists of a ramose corallum with few, long branches, remotely coalescent. Towards the apical parts of the branches the calicles are less raised than in the type, being scarcely 1 mm. above the general surface. On the thick branches they may be as prominent, or be scarcely raised; while in many places, as occurs also in the type specimen of Milne-Edwards and Haime, they are sunk in shallow, circular depressions about 8 to 9 mm. in diameter, so that curved ridges are formed between adjoining calicles. The costæ are distinct close to the calicles, but are only faintly marked at the base where they curve downwards, and are not at all marked on the ridges. The septa are rather broad and join the pali directly at the upper part of the shallow cup. In most of the calicles the pali are found as described by Milne-Edwards and Haime, but in not a few the primaries are very small, and often one or two are undeveloped, a condition that brings this species into very close relation with *Oculina valenciennesi*. The calicles seem to be always regularly circular and erect, though both in this and in the type specimen the extremities of the branches, where usually oval calicles are found in other species, are broken off.

The species is very close to the *Oculina varicosa*, Lesueur, but is distinguishable by the smaller, shallower and less prominent calicles which are not swollen at the base.

Locality.—Bermuda.

6. *Oculina recta*, n. sp. (Pl. I. figs. 5–5*b*).

Corallum much branched, with the branches elongated and irregularly ascending, often coalescent, about 10 to 15 mm. in diameter at the basal stock, and diminishing gradually in size to about 5 mm. at the apex, but often subequal throughout a large extent. Calicles very evenly prominent, being about 1·5 to 2 mm. above the general surface, with their sides regularly perpendicular to the branches, circular, rather deep but sometimes shallow especially towards the basal parts, about 2 to 3 mm. in diameter, rather crowded in spiral lines, about 3 to 5 mm. apart; the cups are often sunk in a slight depression in which the costæ are generally visible, though not continued on the slight intercalicinal ridges. Septa unequal, exsert, granulated, very thin and knife-like, broad, scarcely separated from the pali except by a very shallow notch. Pali twelve, small, thin and broad, continuous with and slightly thicker than the septa owing to the rougher granulations on their sides. Columella papilliform, generally fused in a solid mass with the inner edges of the pali. Surface very finely granulated.

This species is close to the *Oculina speciosa*, but is distinguishable by the rather deep and prominent calicles with perpendicular sides; by the thinner septa, and by the thin pali which are scarcely separated from the septa and are sunk down in the calicular fossa. It is represented by two specimens.

Locality.—St. Thomas, West Indies.

7. *Oculina bermudensis*, Duchassaing and Michelotti.

Oculina bermudiana, Duchassaing and Michelotti, Suppl. Mém. Cor. des Antilles, p. 68, pl. ix. figs. 1, 2.

The specimen of this species consists of a large, branching, dense corallum, rising apparently from many points of attachment, and becoming very coalescent. Its highest branches rise to about 34 cm. and the chief basal partsare nearly 3·5 cm. thick, while in the type specimen, which was of small growth, the greatest thickness was nearly 2 cm. A marked peculiarity of the species, not mentioned in its definition, is the nearly uniform thickness of many of the main branches, which thus become very obtuse at the apex, and show but little tendency to produce branchlets, which when produced are nearly as thick and blunt as the main branches, from which they originate. In a few branches, however, this condition is not marked and they become gradually smaller, and even attenuate, the incipient branchlets at different points of the corallum being

very irregular, and varying from 8 mm. to 25 mm. in thickness. The branches and branchlets are terminated by an apical calicle. The calicles are irregularly placed, uniformly circular, varying from 3 to 5 mm. in width, but the average size is 4 mm. They are somewhat shallow, slightly prominent at the apical parts, but with a distinctly raised margin, becoming very sunken on the thick branches of the base, so as to render the general surface very uneven, owing to the prominent intermediate ridges thus formed. These ridges are marked by a central depressed line which forms the outer limit of the costæ, which are very unequal, distinct, and curved. There are usually twenty-four septa, but they vary from twenty to twenty-six in a few calicles, slightly exsert, and granulated; pali twelve, very granulated, thin, and becoming confluent in their inner parts with the well-developed columella.

This very interesting species, of which one specimen has hitherto been found, resembles *Oculina banksi* (*Oculina mammillaris*) in many of its characters, but is quite distinct from it.

Locality.—Bermuda.

Genus 2. *Acrohelia*, Milne-Edwards and Haime.

Acrohelia, Milne-Edwards and Haime, Cor., ii. p. 115.
„ Duncan, Rev. Madrep., p. 40.

A single species of this genus is represented.

Acrohelia horrescens (Dana).

Oculina horrescens, Dana, Zoophytes, p. 392, pl. xxviii. fig. 1.
Acrohelia horrescens, Milne-Edwards and Haime, Cor., ii. p. 116.

Two specimens of this species were obtained. They form many branched clumps about 12 cm. high, and but small portions were living when taken. A noticeable feature of the corallum is its somewhat vesicular structure, being much less dense than in other Oculinidæ, and this is apparent even on its outer surface, where it is especially marked in the angles of the branches and at the upper junctions of the calicles on the basal parts of the corallum.

Locality.—Banda, taken from the shore at low water.

Genus 3. *Amphihelia*, Milne-Edwards and Haime.

Amphihelia, Milne-Edwards and Haime, Cor., ii. p. 118.
„ Duncan, Rev. Madrep., p. 39.

A single species of this genus is represented.

Amphihelia infundibulifera (Lamarck).

Oculina infundibulifera, Lamarck, Hist. Anim. sans. Vert., p. 457, 1836.
Amphihelia infundibulifera, Kent, Proc. Zool. Soc. Lond., 1871, p. 276, pl. xxiv.

A very fine and large specimen of this rare species was obtained. It is more than 22 cm. in height, with numerous irregular subflabellate branches, being about 17 cm. at its widest part. A very good description of this species, accompanied by a figure, is given by Saville Kent.

Locality.—Ternate.

Genus 4. *Madracis*, Milne-Edwards and Haime.

Madracis, Milne-Edwards and Haime, Cor., ii. p. 139.
„ Duncan, Rev. Madrep., p. 45.

The single species of this genus, which is represented, was described by Duchassaing and Michelotti under a new genus *Reussia*, for which, as the name was previously employed, Saville Kent proposed the name *Pentalophora*. Following Verrill and Pourtalès, I have sunk *Pentalophora* in the present genus, since they are separated by but slight characters.

Madracis decactis (Lyman).

Astræa decactis, Lyman, Proc. Boston Soc. Nat. Hist., vi. p. 260.
Reussia lamellosa, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 63, pl. ix. figs. 7 and 8.

The form of this species is very variable. Pourtalès records that it is generally thin and incrusting, but also at times rises into club-like masses, and even takes the form of thick branches bluntly expanded at the end. The specimen described and figured by Duchassaing and Michelotti as *Reussia lamellosa* is lobate and bluntly ramose; while the specimen obtained by the Challenger on the reefs at Bermuda is a moderately thick and long branch somewhat narrowed and compressed at the summit, obtuse and furcate, and largely incrusted with foreign matter at the base. It is about 5 cm. long and 1·5 cm. thick. The calicles are somewhat deeper and the septa less exsert than in the ordinary massive specimen, but with the exception of its longer and narrower form, it differs in no constant character from the typical specimens of the species.

The plate ix. fig. 7 of Duchassaing and Michelotti apparently gives the magnified view of the corallum, and not fig. 9, as stated in the text.

Locality.—Bermuda.

Genus 5. *Stylophora*, Schweigger.

Stylophora, Schweigger, Beobacht. Naturf., 1819.
„ Milne-Edwards and Haime, Cor., ii. p. 133.
„ Duncan, Rev. Madrep., p. 45.

Of this genus five species are represented. In one of these, *Stylophora cellulosa*, a curious modification of the typical styliform columella is found; for while in the calicles

on the apical parts of the branches and branchlets a small style is visible at the junction of the septa, no indication of it is present in the other calicles of the corallum, where the columella takes the form of a thick central concave mass with which the septa are united.

1. *Stylophora digitata* (Pallas).

Madrepora digitata, Pallas, Elench. Zooph., p. 326.
Pocillopora andreossyi, Savigny, Egypte, Polyp., pl. iv. fig. 3.
Stylophora digitata, Milne-Edwards and Haime, Cor., ii. p. 135.

Two specimens were collected which, though presenting interesting varietal differences, can be separated from this species by no constant characters. In the one, which is large and thick, many of the branches are divaricate or subdivaricate, very swollen and obtusely rounded at the apex; the calicles are quite large and rather far apart, and the labial projections small, more especially at the apical parts. In the other, which is of much smaller growth, the branches are much subdivided and ascending, becoming quite small and subacute above, and the calicles are rather smaller and closer and less prominent at the upper margin.

A very good description, with figures, is given by Klunzinger in his work on the Red Sea Corals.

Localities.—The larger specimen from Somerset, Cape York, 5 fathoms; the smaller from Amboina.

2. *Stylophora flabellata*, n. sp. (Pl. I. figs. 1–1*b*).

Corallum flabellate; the branches subequal, rapidly dichotomising at a rounded angle and always regularly in the same plane, very unevenly bent, compressed so as to present an elliptic outline in transverse section, which is uniformly about 8 to 10 mm. in diameter in the long axis, though somewhat less at the base; branchlets slightly smaller than the branches, quite short, subterete, very obtusely rounded. Calicles circular or subcircular, rather deep and large, 1 to 1·5 mm. in diameter, very elongately spinulous at the margin, not touching but often separated from each other by wide interspaces, nearly even with the surface, and not prominent at the upper margin. Septa six, extremely narrow above, where they are seen as slightly thickened prominent spinules at the margin of the calicle, distinct only at the basal part of the fossa, where they thicken and unite at the centre to form a thick central columella which is produced upwards as a small style, and which is generally slightly elongated in the direction of the long axis of the branch. The interseptal chambers are usually very deep, especially those which are situated at the distal part of each calicle; they are generally narrow, but

become wider on the apical portions of the corallum. Secondary septa absent, probably represented by the small elongated spinules situated between those corresponding to the primary septa at the margin of the calicles.

The styliform prolongation of the columella small, short and pointed, sometimes slightly broadened, and generally more conspicuous in the apical calicles. Cœnenchyma very dense at the surface, but light and cellular within; surface very distinctly and finely echinulate.

This species resembles somewhat the *Stylophora pistillata*, but it may easily be distinguished from it. The smaller distant calicles which are even with the surface, not prominent above, and which never attain the great depth of those of *Stylophora pistillata*, will serve to mark it. The nature of the septa, which are never broad as in *Stylophora pistillata*, and the interseptal chambers, the columella, and the general habit of the corallum furnish additional characters.

A single rather large specimen was obtained, in which the flabellate mode of growth is very clearly marked.

Locality.—Samboangan, Philippines.

3. *Stylophora prostrata*, Klunzinger.

Stylophora prostrata, Klunzinger, Cor. roth. Meer., ii. p. 62, pl. vii. fig. 8; pl. viii. fig. 7.

A very fine specimen and a fragment were obtained, which seem referable to this species, though differing considerably in habit. The stems are much branched and divaricate, and diminish gradually in size, so that the branchlets are small and slender. The corallum tends to spread horizontally, and the branches and branchlets are somewhat flattened in that plane.

Localities.—Tongatabu, 18 fathoms; reefs, Fiji.

4. *Stylophora palmata* (Blainville).

Sideropora palmata, Blainville, Dict. des Sci. Nat., vol. lx. p. 350.
Stylophora palmata, Milne-Edwards and Haime, Cor., ii. p. 137.
„ „ Klunzinger, Cor. roth. Meer., ii. p. 63, pl. vii. fig. 6, and pl. viii. fig. 11.

Specimens in the collection differ in no respect from the Red Sea forms. The branches are of very variable size and form, being either thick and broad and more or less curved, or thick and almost rounded and somewhat swollen at the top. The apical parts are often infested by parasites which make a lodgment in the corallum.

The *Stylophora mordax* (Dana) has been referred with doubt to this species, both by Milne-Edwards and Haime and by Klunzinger; the species certainly does not seem distinct.

Localities.—Ternate; Kandavu and other reefs, Fiji.

5. *Stylophora cellulosa*, n. sp. (Pl. I. figs. 2–2*c*).

Corallum forming, large more or less rounded clumps, the branches of which are elongated, much compressed or angular, and divided throughout into rather broad subpalmate lobes; these branches are from 1·5 to 4 cm. wide and about 7 to 10 mm. thick at their upper part, being often subterete at their base; the lobe-like branchlets are short, broad, rounded or angular, often swollen at their apex, and subdivide rapidly and longitudinally into smaller lobes, apparent as incipient lateral crests, in a plane at right angles to their width. Calicles very crowded towards the apical parts, where they are from 1 to 1·5 mm. in diameter, polygonal and deep, with generally thin, but unequal interspaces, which are of an open cellular structure; towards the basal parts they are circular, smaller and shallower, less crowded but not distant, and separated by dense interspaces; throughout the corallum the calicles are even with the surface and generally fringed by small spinules, those on the distal margin being often rather more elongated than those on the proximal, but the upper edge is neither prominent, arched nor vaulted. Septa six, well developed, those in the extreme distal calicles being very conspicuous, broad and very thin, meeting quite at the centre, the interseptal chambers being very wide and deep; those in the proximal calicles being much less conspicuous, distinct only at the bottom of the fossa, much thickened and not exsert, coalescing with the columella so as to form a thick central mass which is concave above, and which, nearly filling up the bottom of the cup, renders the interseptal chambers small and narrow, though quite deep. The styliform prolongation of the columella generally absent, except in the extreme apical calicles, where it is represented by a very small, short pointed style placed above the point of union of the thin septa. Cœnenchyma very cellular and light throughout the apical parts, but becoming dense at the peripheral parts of the basal portions; surface covered with fine and short spinules.

This species is extremely close to the fossil species *Stylophora raristellata*, from which it differs in that the calicles are closer and are not margined by a solid ring-like edge. The styliform columella also is much less developed than in *Stylophora raristellata*. From the *Stylophora danæ*, to which it is closely allied, it may be distinguished by its less dense cœnenchyma, its narrower branches, its even calicles, which are neither distinctly raised at the margin nor furnished with a projecting upper lip, its much shorter, more thickened, and less developed septa, which throughout the greater part of the corallum, and especially at the basal portion; are distinct only at the bottom of the calicle, and do not take the form of the vertical plates characteristic of the older calicles of *Stylophora danæ*. The styliform columella is also absent, except in the extreme apical calicle, the centre being occupied by a broad concave mass, with which the septa are united, while in the *Stylophora danæ* a distinct styliform columella is

present, and is well developed towards the basal parts as a thick, pointed style placed above the small point of union of the septa.

Two specimens were obtained—one attaining a very great size.

Locality.—Samboangan, Philippines.

Family Pocilloporidæ.

Genus 1. *Seriatopora*, Lamarck.

Seriatopora, Lamarck, Hist. Anim. sans Vert., ii. p. 282, 1816.
„ Milne-Edwards and Haime, Cor., iii. p. 311.
„ Duncan, Rev. Madrep., p. 47.

An altogether new light has lately been thrown upon the structure of this genus by the researches of Professor Moseley.[1] It appears that the presence of a pair of deep lateral pits in the calicle must be regarded as an essential character in the definition of the genus as based on the corallum. As seen in several Challenger specimens, the degree of development of the septa, and the relation of these to each other and to the lateral pits, seem to vary considerably, not only in different species, but even in the different parts of the same specimen. Thus in *Seriatopora stellata* the six primary septa are large, well developed and exsert, and usually regularly arranged, so as to form equal interseptal chambers. In many calicles secondary septa are developed in the distal lateral chambers. The deep pits are always situated in the median lateral chambers, and no pits are to be found in either the distal or proximal lateral chambers. In the *Seriatopora conferta*, in the calicles on the basal part of the corallum, a condition closely similar to this is met with, while the secondaries are more developed; but in the calicles towards the apical parts of the corallum, where the fossa is very deep and the distal margin of the calicle arched, the septa are very slightly developed and often rudimentary, while the deep pits are situated at the proximal portion of the fossa and not at or towards the median portion. In the *Seriatopora crassa*, the septa are much less developed, but the proximal and distal lateral chambers in many of the calicles are much deepened and present an approach to the condition found in *Stylophora*, in which genus the six primary interseptal spaces are all deep. In this species, however, the proximal lateral chambers are often subdivided by secondary septa.

From those species of *Stylophora* with prominent calicles, in which a marked bilateral symmetry is present, species of *Seriatopora*, such as *Seriatopora stellata*, can be distinguished only by the presence of the two deep lateral pits.

Twelve species of this genus are in the collection.

[1] Notes on the Structure of Seriatopora, &c., *Quart. Journ. Micr. Sci.*, new ser., vol. xxii., 1882, p. 390.

1. *Seriatopora caliendrum*, Ehrenberg.

Seriatopora caliendrum, Ehrenberg, Cor. roth. Meer., p. 123.
„ „ Klunzinger, Cor. roth. Meer., p. 70, pl. vii. fig. 12; and pl. viii. fig. 3.

Specimens in the collection differ in no respect from the Red Sea forms. The branches are often very delicate, with slightly prominent or vaulted and rather deep calicles, which have a more or less well-developed pointed columella and distinct septa, which are more distinct towards the apical parts. The lateral pits are generally well marked.

Localities.—Samboangan, Philippines; and reefs, Fiji.

2. *Seriatopora valida*, Ehrenberg.

Seriatopora valida, Ehrenberg, Cor. roth. Meer., p. 123.
„ „ Milne-Edwards and Haime, Cor., iii. p. 313.

Some very fine specimens of this species were collected. The chief peculiarity of the species seems to be the great coalescence of the branches, which are at the same time much compressed, especially at their basal part, to form wide, subflabellate, reticulated pieces. The branches above tend to become parallel and are often much elongated; the calicles are small and in very distinct series, and the upper border is often distinctly prominent and vaulted, especially in those parts of the corallum that are not subject to abrasion.

Locality.—Samboangan, Philippines.

3. *Seriatopora gracilis*, Dana.

Seriatopora caliendrum, var. *gracilis*, Dana, Zoophytes, p. 522, pl. xlix. fig. 4.
„ *gracilis*, Dana, Coral and Coral Islands, p. 334.

The characters which separate this species from *Seriatopora caliendrum* are exceedingly slight. The corallum is more uniformly of a light texture, the cells are more distinctly and prominently vaulted, the septa are less distinct, and the columella more distinct and pointed towards the basal parts. Small specimens in the collection have the branches fistular, being bored throughout by one or more canals.

Locality.—Ternate.

4. *Seriatopora contorta*, Studer.

Seriatopora contorta, Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1878, p. 541, pl. iii. fig. 12.

A single specimen in the collection evidently belongs to this species, though differing considerably in the size of the calicles from the description given by Studer. It seems

however, that the calicles are very rarely 1 mm. wide, the average size being scarcely more than 0·5 mm. Often they are scarcely or not at all prominent. In the extremely spinous nature of the branches, in this species limited to the upper portion, it approaches the *Seriatopora spinosa;* while the size and character of its cups and the compressed and coalescent nature of its branches relate it to *Seriatopora valida,* from which it seems scarcely justifiable to separate it.

Locality.—Samboangan, Philippines.

5. *Seriatopora cervina* (Lamarck).

Porites cervina, Lamarck, Hist. Anim. sans Vert., ii. p. 271, 1816.
Seriatopora cervina, Milne-Edwards and Haime, Cor., iii. pp. 312 and 314.
„ „ Brüggemann, Ann. and Mag. Nat. Hist., ser. 4, vol. xix., 1877, p. 418.

Two small specimens in the collection I have referred to this species, with which they agree in essential structure. The cells are generally rather far apart, especially at the basal part, and this gives a rather dense texture to the corallum. The structure of these small specimens agrees exactly with that of the basal and outer branches of large specimens of the species. One of the small specimens, from Banda, has a very roughly echinulate surface and generally very small branches, but it agrees so closely in other parts that it can only be regarded as a peculiarly grown specimen of the same species.

The *Seriatopora compressa,* Studer, is very close to this species.

Localities.—Samboangan, Philippines; Banda.

6. *Seriatopora compressa,* Studer.

Seriatopora compressa, Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1878, p. 541, pl. iii. fig. 11.

Two small specimens were collected which agree well with the description and figure of this species. In many calicles the upper margin, though finely divided, is not at all prominent. The septa are not perceptible except at the bottom of the cup, where a columella is present and is generally more developed and pointed in the calicles towards the apical parts of the branches; in the more basal calicles, the columella is broad, low, and scarcely marked, and the lateral pits are of very small dimensions, and often nearly obsolete. In general habit the species approaches the *Seriatopora valida.*

Locality.—Samboangan, Philippines.

7. *Seriatopora stellata,* n. sp. (Pl. II. figs. 4–4*b*).

Corallum closely ramose; the branches subequal, about 7 to 10 mm. thick, often coalescent, terete or slightly compressed where two or more coalesce, ascending, often

much divided and subdivaricate, especially at the outer parts; branchlets somewhat smaller than the branches, rather short and subacute, not winged at apex. Calicles generally crowded, rather shallow, quite small, about 0·5 or 0·75 mm. in diameter, regularly circular, irregularly placed, but often distinctly seriate near the apical parts, where the upper wall is generally rather arched and prominent; throughout the greater part of the corallum, especially towards the apical parts, the whole margin of the calicle is distinctly raised and rimmed, owing to the prominence and regularity of the marginal spinules, sixteen to twenty-four in number, which are often broad and septiform, and in the case of the larger ones are continuous with the septa which are developed within the calicle. Septa, generally six, extremely well developed at the sides and upper portion of the cup, but not distinct at the bottom of the fossa, broad, thickened and exsert, placed regularly apart with equal or subequal interseptal spaces; in many calicles two additional septa are present, situated one in each of the distal lateral chambers, but these septa are always very small and rudimentary. Columella conspicuous, compressed, narrow, styliform and pointed, projecting nearly to the margin. The two lateral pits are rather small and extremely deep, situated midway between the proximal and distal margin of the calicle. Texture compact; surface spinulose, the spinules being rather short and acute, though often thickened and long.

The thick and strong branches, the shallow calicles and subexsert columella, the great development of the prominent septa, together with the raised continuous marginal rim to the calicles will readily mark the species, which has much of the general habit of *Stylophora subseriata*, while in essential characters it seems to be allied to the fossil species, *Stylophora costulata*.

A single specimen was collected.

Locality.—Reefs, Fiji.

8. *Seriatopora ocellata*, Ehrenberg.

Seriatopora ocellata, Ehrenberg, Cor. roth. Meer., p. 122.
„ „ Milne-Edwards and Haime, Cor., iii. p. 313.
„ „ Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1878, p. 540, pl. iii. fig. 10.

Two very fine and interesting specimens of this species were collected. In essential characters they agree in every respect, but the habit of growth differs considerably. In one the branches are much divided and coalescent at very short intervals, so that the clump becomes close and intricate; while in the other the branches are less divided and more elongated, coalescent at longer intervals, the aspect of the clump becoming more loose and elevated. The species is quite distinct from *Seriatopora spinosa*. The cells are very large and open, and at the base they are in indistinct series and are separated

by interspaces equal to their diameter; higher on the branches they become even larger, more distinctly seriate, with a very slight and angular, echinulate projection of the upper wall; at the extreme apical parts they are very distinctly seriate, oval or elongated, and 1·5 mm. in the long diameter, with very narrow divisions between them in the same series, and with extremely thin interseriate divisions. The septa and columella are almost indistinct, a narrow lamellate columella being generally present towards the apical parts. The ends of the branches are obtuse, thick, of very light texture, and very distinctly winged.

Locality.—Samboangan, Philippines.

9. *Seriatopora crassa*, n. sp. (Pl. II. figs. 3–3*d*).

Corallum large, heavy, forming broad and convex clumps of thick, rounded or slightly flattened branches which are much divided, intricately coalescent and obtuse. Branches about 1 cm. thick at base, often much wider at their point of coalescence, gradually lessening to about 5 to 7 mm. at about an equal distance from the apex, which is thick, rounded, and not winged. Throughout the entire corallum the branches dichotomise regularly at about every 5 to 7 mm. of their length, nearly at right angles, the larger number of the resulting very short branchlets coalescing with those of adjoining branches. Calicles subcircular or oval, generally small, about 0·5 mm. in diameter, slightly more towards the upper parts, where they often become nearly 1 mm. wide in the long diameter, scattered, and more or less indistinctly seriate at the base, where they are separated by spaces more than their own diameter in width, more closely placed and crowded on the apical parts, with spiral and linear series seldom distinctly and continuously marked even at the apex, prominent at the upper margin which is rounded, often oblique and finely divided. Septa of six primaries and rudimentary secondaries, seldom prominent, distinct only deep down in the cup where they are more or less rib-like. Columella well developed, conspicuous and pointed. Lateral pits in the median lateral chambers large and deep; generally four smaller and shallower pits well-marked in the other four primary interseptal spaces, of which the proximal pair are frequently subdivided by secondary septa. Surface very closely beset with fine spines, which sometimes form polygonal areas around the calicles. Texture very firm and compact.

This very distinct form has very much of the general habit of the intricately branched variety of *Seriatopora ocellata*. In essential structure it closely relates the genus to *Stylophora*, a decided approach being made to the distinct, deep primary interseptal spaces of that genus.

A single typical specimen was obtained, in which, however, a large part of the corallum has been injured by weathering.

To this same species another specimen has been referred, though very doubtfully. The specimen is characterised by the same robust habit, and its mode of growth is

exactly similar; but its essential structure differs in many particulars which may, however, be merely varietal. The calicles are larger and more distinctly circular, sometimes oval, with the long axis in the line of the branch, but very frequently perpendicular to it; the septa are less distinct; the proximal and distal lateral pits are generally scarcely marked; and the columella is much wider at its basal part, while its free projecting edge is thinner and sharper. For the present I distinguish it as *Seriatopora crassa*, var. *transversa*, though it seems almost justifiable to rank it as a distinct species, as *Seriatopora transversa* (Pl. II. figs. 3*c* and 3*d*).

Locality.—Mactan Island, Philippines.

10. *Seriatopora hystrix*, Dana.

Seriatopora hystrix, Dana, Zoophytes, p. 521, pl. xlix. fig. 3.

Two large and very fine specimens of this species were obtained. One possesses exactly the characters given by Dana; but the other differs in not having the branchlets of the central parts elongate, and subparallel as in Dana's figure; on the contrary the branchlets are divaricately branched throughout and are generally very shortly subulate. The two specimens agree so closely, however, in other respects as to be inseparable. The latter variety seems to be very close to, if indeed distinct from, the *Millepora lineata*, Linnæus.

Locality.—Levuka, Fiji.

11. *Seriatopora aculeata*, n. sp. (Pl. II. figs. 2–2*c*).

Corallum forming a much branched, coalescent, irregularly spreading and subprostrate clump, the branches of which are very short and thick, and are terminated above by a very suddenly pointed spine; the branches and branchlets subdivide at very short intervals into two, three or more shoots, becoming much swollen at their point of origin, so as to resemble rounded knobs, on or about which the new branchlets develop. The diameter of the chief branches is about 8 to 10 mm., but often by the coalescence of several parts, very thick masses are formed. The swollen terminal knobs of the branches are from about 6 to 9 mm. in diameter, and they form the basal part of the shoots, which are from 3 to 8 mm. in length, very sharply acuminate, and strong. The calicles are rather large, about 0·75 to 1 mm. in diameter, very regularly circular and open, often unevenly distant and indistinctly seriate, but very distinctly arranged in six rows on the terminal branchlets, rather deep, with two extremely deep lateral pits; the upper walls are extremely prominent, evenly rounded, and very strongly and uniformly ribbed on the upper surface, the ends projecting at the edge of the wall. The calicles thus simulate very closely the reversed short open tubo-nariform calicles of a *Madrepora*.

The septa are generally quite indistinct, but are seen within as lines of fine spinules. The columella is well developed, compressed and pointed, minutely spinulous. The surface throughout is very abundantly spinulous, the little spines being often arranged in angular areas around the calicles; at the extreme apical parts of the branchlets the surface is generally more or less pitted and cellular.

This species has, like the *Seriatopora spinosa*, spine-like branchlets, but the two species differ altogether in the form and relation of the branches and branchlets, and in the form and characters of the calicles. In this species the short, sharp, and thick branchlets may be described as being more or less terminal, while in *Seriatopora spinosa* they are very numerously placed along the long axis of the branches and are small and thin. A single small specimen was obtained. Many of its branches are fistular, being bored throughout by one or more canals.

Locality.—Ternate.

12. *Seriatopora conferta*, n. sp. (Pl. II. figs. 1–1*c*).

Corallum forming a rather light, much ramified, intimately coalescent, densely crowded and rather broad clump, in which the branches are divaricately divided at very short intervals. Branches about 5 mm. thick at their widest part, rounded and lessening slightly towards the apical parts; branchlets quite short, about 3 mm. thick at their base, obtusely rounded and not winged at the apex. Calicles generally circular, often oval towards the base, small, about 0·5 mm. wide, extremely deep especially towards the upper part of the corallum, distinctly seriate and crowded except towards the base; the upper wall usually prominent and rounded, arched forwards so as to make the fossa very deep and curved within, finely ribbed on its upper surface, and closely fringed at the margin with fine long spinules. Septa usually distinct and well developed, especially conspicuous in the shallower cups at the base, where they often form six slightly exsert, rather broad and thick lamellæ with rudimentary secondaries irregularly developed; towards the apical parts, the septa are much less distinct, the six primaries becoming quite small and often rudimentary, visible only as small markings deep down in the fossa, while the edge of the calicle becomes very distinctly margined by very fine and sharp elongated spinules. Columella well developed, compressed and pointed, but not conspicuous except in the basal calicles, being situated far down in the deep fossa in the other calicles. Lateral pits large and very deep, situated close to the proximal end of the fossa in the deep calicles; towards the basal parts they become more median. Surface delicately spinulose, the spinules being long and very fine.

The general habit and mode of branching, the nature of the branches and branchlets, and the essential structure of the calicles will easily serve to distinguish this species. Two rather large specimens were collected, in one of which the septa are much more

developed than in the other, especially towards the apical parts. In both specimens many of the branches are fistular, being bored by one or more canals; and owing to this, and to the thinness of the branches and branchlets, and to the deep and crowded calicles which cover them, the corallum becomes comparatively light.

Locality.—Kandavu, Fiji.

Genus 2. *Pocillopora*, Lamarck.

Pocillopora, Lamarck, Hist. Anim. sans Vert., ii. p. 273.
„ Milne-Edwards and Haime, Cor., iii. p. 301.
„ Duncan, Rev. Madrep., p. 47.

The real affinities of this genus were first determined by Verrill,[1] and confirmed by Professor Moseley, to whose research we are indebted for a more complete knowledge of the soft parts.[2]

Fourteen species of this genus were obtained.

1. *Pocillopora acuta*, Lamarck.

Pocillopora acuta, Lamarck, Hist. Anim. sans Vert., ii. p. 274.
„ „ Milne-Edwards and Haime, Cor., iii. p. 302, pl. F. 4, fig. 2.

This species is extremely variable in the shape and thickness of the branches and branchlets and in the size of the calicles. The branches and branchlets may be subterete or slightly compressed and angular, acutely or nearly obtusely rounded at the end, thick and strong or rather slender, of very close and shrubby habit or elongated and subarborescent, of very dense and compact structure throughout or open cellular within. The calicles are always crowded, with the interspaces generally marked by fine lines which surround the calicles, towards the apical parts the interspaces become extremely narrow and the linear markings are absent; the diameter of the cups is generally about 0·5 mm. to 1 mm. or more (in the type specimen of Lamarck the calicles are very small); the septa are more or less distinct especially in the apical parts, and are seen as minutely spinulous lines when magnified; the columella is distinct and forms a sharply convex spinulous projection elongated in the long axis of the branch. The surface is very sharply echinulate.

According to these differences in habit and structure, individual specimens may appear specifically distinct from each other, while in a large series of specimens it will be found impossible to separate them by any constant character.

A very interesting variety of the species was obtained at Banda; in this the branches are often compressed, and are almost obtusely rounded above and of very shrubby growth; the calicles are quite large and are scarcely crowded at the basal parts; the cœnenchyma is

[1] *Proc. Amer. Assoc. Adv. Sci.*, 1867.

[2] *Quart. Journ. Micr. Sci.*, new ser., vol. xxii., 1882.

scarcely compact even at the base, thus giving a very light texture to the corallum; the spinules of the surface are very fine, long and sharp. Though apparently so distinct from the ordinary form of the species, it is impossible to separate it, since a large specimen from Amboina furnishes more or less intermediate characters between it and the more commonly occurring form. It may, however, be distinguished as the *Pocillopora acuta*, var. *fragilis*.

The *Pocillopora ramiculosa*, Verrill, does not seem to be distinct from this species.

Localities.—Banda; Amboina; Mactan Island, Philippines.

2. *Pocillopora paucistellata*, n. sp. (Pl. I. figs. 3–3*a*).

Corallum ramose, lax; consisting of few rather thick, terete or subterete, elongated, spreading branches, more or less prostrate and divided, which diminish gradually in size and give off at intervals comparatively few, small, subacute, short branchlets. Calicles large, about 1 mm. or more in diameter, very shallow and open, circular or slightly oval, never crowded even at the apical parts, separated by broad interspaces which are not marked by lines surrounding the calicles. Septa absent or quite indistinct even when the calicles are magnified. Columella absent, the bottom of the cup being finely spinulous and flat or subconcave. Surface often nearly smooth, unevenly marked by very short and rudimentary spinules, which are more distinct at the edge of the calicles, cœnenchyma extremely compact throughout.

This species resembles generally the *Pocillopora acuta*, but differs from it in its much more lax and elongated habit, in its distant and shallow cells, which are never crowded even at the apex, and the absence of septal markings and of a columella, and in the very short and rather distant spinules of the surface, which consequently appears almost smooth.

Locality.—Ternate.

3. *Pocillopora suffruticosa*, Verrill.

Pocillopora suffruticosa, Verrill, Bull. Mus. Comp. Zoöl. Cambridge, U.S.A., vol. i. p. 60.

A large and interesting specimen was obtained which agrees well with the short and incomplete description of Verrill. The clump is densely branched with many large, clustered, elongated, subterete stems, which frequently divide and subdivide, the resulting branches being very proliferous throughout their whole length, and crowded with short branchlets. The calicles are small, 0·5 or 0·75 mm. wide, circular or oval and rather deep, separated by spaces less than their diameter; the septa are developed, and in the calicles on the branchlets are distinctly seen, when the calicle is magnified, as finely spinulous lamellæ, which are less marked in the calicles on the main branches; the upper and lower septa in each cup slightly enlarged. Columella small, rather prominent.

The species is close to the *Pocillopora cespitosa*, from which it can be distinguished by its more fruticose habit, its small cells, and the developed septa and columella. It is extremely close to the *Pocillopora gracilis*, which agrees with it in all essential particulars, and, differing only in the more slender habit, seems thus to be only a variety of the species.

Locality.—Tongatabu.

4. *Pocillopora cespitosa*, Dana.

Pocillopora cespitosa, Dana, Zoophytes, p. 525, pl. xlix. fig. 5.
„ „ Verrill, Proc. Essex Inst., vol. vi. p. 91.

This species is exceedingly close to the *Pocillopora brevicornis*, though according to Verrill it is distinct from it. The typical form can readily be distinguished by its large cells (about or more than 1 mm. in diameter) and its thinner and more irregularly placed branches; while the *Pocillopora brevicornis* is at the same time marked by its small cells (much less than 1 mm.) and its thickened, short, stumpy and close branches and branchlets. Not infrequently, however, the species takes on the short, suppressed growth of the *Pocillopora brevicornis*, when its cells become markedly smaller, and in this form it is extremely difficult to determine between the two species.

A fragment from Tahiti, which is not separable from this species, is peculiar in the great size and depth of its calicles. These are occasionally as much as 2 mm. in diameter.

Localities.—Reefs, Honolulu, and at depths from 1 to 2 fathoms; Tahiti.

5. *Pocillopora brevicornis*, Lamarck.

Pocillopora brevicornis, Lamarck, Hist. Anim. sans Vert., ii. p. 275.
„ „ Dana, Zoophytes, p. 526, pl. xlix. fig. 8.

A very fine specimen and some fragments were obtained. In many parts of the corallum the branches become rather slender and elongate, and take on the characteristic shape of the *Pocillopora bulbosa*, from which it is thus difficult to separate the species.

Localities.—Api, New Hebrides; reefs, Fiji.

6. *Pocillopora damicornis* (Esper).

Madrepora damicornis, Esper, Pflanz. Forts., i. p. 43; Madrep., pl. xlvi. A.

A single rather large and more or less rounded clump was obtained, which agrees very closely with the figure and description given by Esper. The basal calicles are circular,

about 1 mm. in diameter or more, rather shallow, and separated by interspaces rather less than their diameter; the distal calicles elongated and irregular, rather larger, deep and very close, separated by very narrow walls. When strongly magnified they are seen to be very finely spinulous within, and in many of the apical cups the septa are very finely marked and represented by spinulous striations. The columella is scarcely developed, round, and spinulous.

Locality.—Samboangan, Philippines.

7. *Pocillopora danæ*, Verrill.

Pocillopora favosa, Dana (*non* Ehrenberg), Zoophytes, p. 528, pl. 1. fig. 1.
Pocillopora danæ, Verrill, Proc. Essex Inst., vol. vi. p. 93.

A small specimen of this species was collected. Except in the extreme apical calicles, the septa are represented by fine and often elongated spinules, which are also present on the scarcely distinct columella.

Locality.—Samboangan, Philippines.

8. *Pocillopora solida*, n. sp. (Pl. I. figs. 4–4*d*).

Corallum consisting of rather elongated, subarborescent, much divided branches which dichotomise regularly at intervals of about 15 mm., often divaricate; they are nearly equal throughout, verrucose, subterete or slightly compressed, being about 15 mm. wide and 10 mm. thick, slightly more towards the base. The verrucæ are very short, very unequal, irregularly placed, rarely crowded, generally separated by spaces more than their own diameter; they consist usually of two, three, or four large cells, rarely more, which are often barely raised above the surface; they are not found on the summits of the branches except on those towards the basal parts, where they are often longer and more irregular; they are absent on the basal part of the main stem and are more or less obsolescent on its upper portion and on the basal part of the smaller branches. Cells on the verrucæ quite large, about 1·5 mm. wide, deep, circular, with very elongated spinules on the upper margin, the spinules of adjoining calicles being placed in rows and continuous with the septa within; between the verrucæ and on the basal parts they are neatly circular, rather deep, generally quite small, 0·5 to 0·75 mm. in diameter, rarely more, rather closely placed above but generally separated by spaces more than their own diameter, especially towards the basal parts; on the apex of the upper branches the cells are subpolygonal and very closely placed. The septa are very slightly developed, and, when the calicles are magnified, are seen as minutely spinulous striations, which are more distinct in the cells on the verrucæ, where the uppermost septa are quite distinct. Columella inconspicuous and rounded or quite absent. Cœnenchyma

very compact, except on the apical parts of the upper branches; surface with very short and minute spinules, which are rather scattered and wide apart, except on the verrucæ, where they become longer and closer.

In the apical subpolygonal calicles of this species the tabulæ can be very easily traced. In these cells the septa are but slightly developed, and the tabulæ originate as slight ring-like thickenings within the calicle at some distance from the edge. By the concentric growth of this thickening a complete floor is formed which shuts in a wide intertabular chamber below. According to the stage of development of the tabula the central portion may be pierced by an opening of greater or less extent, which gradually lessens and eventually is altogether obliterated when the tabula is complete.

This species is very distinct from all other known forms, and is represented by a rather large specimen, which grew in a more or less horizontal position.

Locality.—Tahiti.

9. *Pocillopora ligulata*, Dana.

Pocillopora ligulata, Dana, Zoophytes, p. 531, pl. l. fig. 2.

Two rather small specimens were collected. They agree in all respects with Dana's excellent figure and description.

Locality.—Honolulu.

10. *Pocillopora plicata*, Dana.

Pocillopora plicata, Dana, Zoophytes, p. 534, pl. l. fig. 7.

The specimens which were referred by Dana to this species have been separated by Verrill,[1] the form from the Sandwich Islands being referred to a new species, *Pocillopora aspera*. Two specimens and some fragments in the collection, which apparently are identical with the *Pocillopora aspera*, agree so closely with the *Pocillopora plicata* that it seems necessary to reunite the two forms under their original name. The outer branches of the species are not at all plicate, but are more or less straight, elongated, and compressed.

Locality.—Reefs, Honolulu, at depths of 1 to 2 fathoms.

11. *Pocillopora nobilis*, Verrill.

Pocillopora verrucosa, Dana (*non* Ellis and Solander), Zoophytes, p. 529, pl. l. fig. 3.
„ *nobilis*, Verrill, Proc. Essex Inst., vol. vi. p. 97.

Two fine specimens and numerous fragments of the species were obtained. In one specimen the branches are often quite thin, though generally broad, while in the other

[1] *Proc. Essex Inst.*, vol. vi. p. 93–96.

they are much enlarged. The verrucæ are generally very crowded, small, short, and angular; the calicles when strongly magnified are seen to be distinctly stellate, with the septa numerously and finely spinulose, larger towards the centre; the species is very close to the *Pocillopora verrucosa*, but seems to be distinguishable by the much smaller and shorter verrucæ, which are scarcely pronounced at the apex, by the much more distinct and more spinulose septa, and by the finer spinulation of the surface.

Locality.—Reefs, Honolulu, at depths of 10 to 40 fathoms.

12. *Pocillopora verrucosa* (Ellis and Solander).

Madrepora verrucosa, Ellis and Solander, Zoophytes, p. 172.
Pocillopora verrucosa, Milne-Edwards and Haime, Cor., iii. p. 305.

A single large specimen and a few fragments were collected. The species is well characterised by the crowded, large and much elongated verrucæ which are placed on all sides and on the apical parts of the branches. Towards the base the verrucæ become more swollen and rounded. The spinules of the surface are coarse and bluntly pointed, often cuneate; the septa are present as distinct striations, obsolescently spinulous; and the columella is large and slightly raised.

Locality.—Reefs, Honolulu, and at depth of 1 to 2 fathoms.

13. *Pocillopora squarrosa*, Dana.

Pocillopora squarrosa, Dana, Zoophytes, p. 530, pl. l. fig. 5.

I have with doubt referred to this species a single rather small specimen, which at the same time is very closely allied both to *Pocillopora nobilis* and *Pocillopora verrucosa*. It has the general habit of the species with the stout and short tuberculous verrucæ, but these become much smaller towards the apex. The characters of the calicles are as in *Pocillopora nobilis*, except that the columella is much more developed and rounded, and that the spinules within the cup are finer and much more numerous. The spinules of the surface are small, crowded and very sharply pointed. Possibly the three species may have to be united.

Locality.—Ternate.

14. *Pocillopora grandis*, Dana.

Pocillopora grandis, Dana, Zoophytes, p. 533, pl. li. fig. 2.

A single specimen of this species was obtained. The branches are very variable in thickness, being from 15 to 30 mm., sometimes swollen towards the apex, where division is taking place; the apex is broad and conspicuously naked, often uneven owing to the

division into smaller parts for new branches; the verrucæ are less crowded in this specimen than is usual in the species, being rather short and subequal, rarely elongating. The calicles are very close, separated by very thin interspaces, more wide apart on the verrucæ and on the basal parts of the branches where narrow septa and a pointed columella are developed. Cœnenchyma scarcely compact, except on the superficial basal parts and on the verrucæ.

Dana's figure "2 *a*" gives a very exact idea of the character of the branches near the apex, except that the intercalicinal spaces are rather wider than is usual.

Locality.—Tahiti.

Subsection ASTRÆIDA.

Family ASTRÆIDÆ.

Genus 1. *Cladocora*, Ehrenberg.

Cladocora, Ehrenberg, Cor. roth. Meer., p. 85.
„ Milne-Edwards and Haime, Cor., ii. p. 587.
„ Duncan, Rev. Madrep., p. 70.

Cladocora arbuscula (Lesueur).

Caryophyllia arbuscula, Lesueur, Mém. du Museum, vol. vi. p. 275, pl. xv. fig. 2.

A single specimen was obtained in shallow water. Pourtalès records that it is found in quantities on muddy shoals. An interesting fact is the occurrence of the same species in 10 to 20 fathoms as far south as Simon's Bay, Cape of Good Hope, recorded by Professor Moseley. Very good figures of the species are given by Agassiz, Florida Reefs, pl. iii. figs. 1–7.

Locality.—St. Thomas, West Indies.

Genus 2. *Galaxea*, Oken.

Galaxea, Oken, Lehrb. der Naturg., i. p. 72.
„ Milne-Edwards and Haime, Cor., ii. p. 223.
„ Duncan, Rev. Madrep., p. 118.

Eight species of this genus were obtained.

1. *Galaxea clavus* (Dana).

Anthophyllum clavus, Dana, Zoophytes, p. 403, pl. xxviii. fig. 3.

One living incrusting specimen and a few small dead and somewhat worn specimens, over which *Seriatopora valida* and *Millepora murrayi* have grown, seem referable to

this species. The clavate or cylindrical lobes are much less than two inches thick, sometimes being scarcely one inch. The species in its earliest form grows in an incrusting manner with short calicles.

Locality.—Samboangan, Philippines.

2. *Galaxea explanata*, n. sp. (Pl. IV. figs. 6–6*d*).

Corallum a large, spreading, rather thin, explanate mass formed by an abundant peritheca, with an even, undulate, upper surface in which the cells are very large, loose, and delicate. Calicles, subcircular, angular or polygonal according to the prominence of the larger costæ, small, uniformly from 3 to 4 mm. in diameter at the margin of the wall, rather scattered, about 5 to 8 mm. apart, cylindrical and subparallel, projecting about 5 to 8 mm. above the peritheca. Walls rather thin; costæ remote, thickened and prominent with sharp edges throughout the length of the calicles, those of the first cycle very prominent, those of the second less so, and those of the third cycle generally absent or very imperfectly developed. Septa very granulated, of two cycles complete, a third very small and often incomplete; those of the first cycle rather thick, exsert, projecting about 2 or 3 mm., those of the second much smaller and thinner and often unequal.

This form differs markedly from all the other known species of the genus. Its mode of growth is altogether unique.

Locality.—Levuka.

3. *Galaxea musicalis* (Esper).

Madrepora musicalis, Esper, Pflanz., i. p. 160; Madrep., pl. xxx.
Galaxea musicalis, Milne-Edwards and Haime, Cor., ii. p. 225.

A single rather large specimen of this species was collected. The costæ in many calicles are quite inconspicuous, the wall appearing smooth.

Locality.—Somerset, Cape York; 5 fathoms.

4. *Galaxea fascicularis* (Linnæus).

Madrepora fascicularis, Linnæus, Syst. Nat., edit. xii. p. 1278.
„ „ Ellis and Solander, Zoophytes, p. 151, pl. xxx.
Galaxea fascicularis, Milne-Edwards and Haime, Cor., ii. p. 227.

A single small specimen of this well-marked species occurs in the collection. It consists in great part of a dead corallum, which has been more or less covered by fresh growth, the calicles of which are mostly very small.

Locality.—Kandavu, Fiji.

5. *Galaxea aspera*, n. sp. (Pl. IV. figs. 5–5*d*).

Corallum broadly convex above, subcylindrical, with a very scant peritheca, the cells of which are small and closely placed. Calicles either subcircular and about 6 mm. in diameter at the margin of the wall, or oval, elongated and compressed, and about 9 mm. in the long diameter; elongato-turbinate, but many calicles at different parts of the corallum, and chiefly at the outer margin, very shortly and distinctly turbinate; raised above the peritheca for a large portion of their length, many being free for more than 2 cm., irregularly crowded, generally about 4 to 5 mm. apart, but often very closely placed owing to the development of many small calicles around some of the larger ones (apparently owing to injury). Walls neatly thin; costæ very prominent throughout the length of the free portion of the calicles, distinctly raised but less prominent in the substance of the peritheca, slightly thickened and sharp, those corresponding to the small septa more prominent than those of the larger, less raised at the basal part of the shortly turbinate calicles than at the upper portion. Septa of three complete cycles, a fourth being rudimentary in many of the larger cups, very exsert, projecting about 5 mm., sub-acute above and somewhat fragile, being easily broken away; those of the first and second cycles nearly equal, thickened slightly at the wall and reaching to the centre; those of the third cycle projecting nearly to the centre and quite thin.

This species, like the *Galaxea fragilis*, possesses broad and prominent costæ, but it differs from that form in being much rougher and less delicate throughout, in its larger calicles, in the size and arrangement of the septa and costæ, and in the nature of the peritheca.

In the great prominence of its septa it recalls *Galaxea fascicularis*, *Galaxea hystrix*, and *Galaxea cuspidata*. The *Galaxea fascicularis* may be distinguished by the denser and firmer texture, by the thick walls and septa, which are often very granulated, and by the slightly prominent costæ which are obsolete on the basal part of the calicle where the wall becomes smooth. *Galaxea cuspidata* is well distinguished by its extremely large and regularly turbinate calicles with very thick septa. *Galaxea hystrix* is distinguished by the thick and abundant peritheca, by the cylindrical non-turbinate calicles, which are remotely carinate exteriorly, the wall being nearly smooth except at the upper portion.

Locality.—Amboina.

6. *Galaxea ellisii*, Milne-Edwards and Haime.

Galaxea ellisi, Milne-Edwards and Haime, Cor., ii. p. 228.

The appearance of this species varies much with age. In the young state its colonies are broadly convex, with closely placed calicles, which are subcircular, oblong or much

elongated. The calicles are quite large at the central portions of the colony, and have a diameter of from 5 to 7 mm., some more elongated are about 9 mm. in length and 4 mm. wide; they are free for about 6 or 7 mm., and are quite smooth at their juncture with the peritheca. The first and second cycles of septa are subequal and slightly thickened, the other septa are quite small and thin. In the adult form the colony becomes more or less cylindrical and rises into stout columnar lobes, in which the calicles are smaller and more regular, and the septa more equally thin.

A fine, young specimen was obtained. A figure, which Milne-Edwards and Haime have referred to this species, is given by Ellis, Phil. Trans., liii. pl. xx. fig. 14, 1764.

Locality.—Mactan Island, Philippines.

7. *Galaxea tenella*, Brüggemann.

Galaxea tenella, Brüggemann, Journ. Mus. Godeffroy, vol. xiv. p. 203.

This species is very close to the *Galaxea ellisii*, especially to the young forms of that species. It appears to be distinguished, however, by its much more prominent costæ, its more regular calicles, generally much expanded at the margin, and its thinner more delicate septa.

A single young specimen was obtained.

Locality.—Amboina.

8. *Galaxea fragilis*, n. sp. (Pl. IV. figs. 7–7*d*).

Corallum broadly subcylindrical or irregularly convex, with an unequally developed but abundant peritheca, the cells of which are very large, loose, and delicate. Calicles very delicate and thin throughout, subcircular, oval or slightly elongated and compressed, about 4·5 mm. in diameter from margin to margin of the wall, often nearly 7 mm. in the long diameter of the elongated calicles, elongato-turbinate, projecting very unequally above the peritheca, and from about 5 to 10 mm. high, often about 6 mm. distant from each other, but generally closely crowded together, with scattered small calicles developing numerously at various parts (apparently where the corallum has been injured). Walls very thin throughout; costæ very prominent throughout the free portion of the calicles, very thin, those corresponding to the last complete cycle of septa wider than the septa to which they correspond, and more prominent than those corresponding to the larger septa. Septa of three complete cycles, a fourth very rudimentary, and only seen in a few larger calicles; all the septa are extremely thin and delicate, very exsert, projecting about 4 mm., but fragile and generally broken away, except in those calicles that are protected from friction; septa of the first and second cycles equal and projecting quite to the centre, those of the third cycle very narrow.

This delicate species has many points of resemblance with the *Galaxea cespitosa* (Esper), but it can be most readily distinguished by the remarkable development of the septa and costæ.

A single specimen was obtained.

Locality.—Amboina.

Genus 3. *Caulastræa*, Dana.

Caulastræa, Dana, Zoophytes, p. 196.

The genus *Eusmilia*, Milne-Edwards and Haime, does not seem to differ in any marked particular from this genus, which claims priority, and should therefore be retained.

Caulastræa distorta, Dana.

Caulastræa distorta, Dana, Zoophytes, p. 199, pl. ix. fig. 5.

The forms of this species are much branched, close and short clumps, the branchlets being generally quite short. The septa are often either nearly entire or very unequally denticulate and spinulous.

A fine specimen was obtained.

Locality.—Tongatabu.

Genus 4. *Euphyllia*, Dana.

Euphyllia, Dana, Zoophytes, p. 157.
„ Milne-Edwards and Haime, Cor., ii. p. 191.
„ Duncan, Rev. Madrep., p. 84.

Four species of this genus were obtained.

1. *Euphyllia glabrescens*, (Chamisso and Eysenhardt).

Caryophyllia glabrescens, Chamisso and Eysenhardt, Nova Acta Acad. Nat. Curios., vol. x. pt. 2, p. 369, pl. xxxiii. fig. 1, A. and B.
Euphyllia glabrescens, Milne-Edwards and Haime, Cor., ii. p. 192.

Several specimens of this species were obtained. In one form the corallum becomes much raised and the calicles quite elongated and very deep, while the septa are very broad and loosely arranged; in another the corallum is small and very low the calicles short and stumpy, and the septa much narrower and closer. An intermediate specimen compels their being assigned to the same species. Five cycles are almost constantly developed, though often incomplete.

Localities.—Banda; Somerset, Cape York, shore.

2. *Euphyllia rugosa*, Dana.

Euphyllia rugosa, Dana, Zoophytes, p. 166, pl. vi. fig. 3.
„ „ Milne Edwards and Haime, Cor., ii. p. 194.

A very fine and large example of this species was collected. The transverse wrinkles and the carinato-striate costæ throughout the length of the calicles serve as ready characters by which to distinguish it from the *Euphyllia glabrescens*, but a very close approach is made to it in the larger form of the latter species.

Locality.—Amboina.

3. *Euphyllia turgida*, Dana.

Euphyllia turgida, Dana, Zoophytes, p. 166, pl. ix. fig. 9.
„ „ Milne-Edwards and Haime, Ann. d. Sci. Nat., ser. 3, vol. x. p. 268, pl. vi. fig. 1.

This species is very variable in the shape and size of its calicles. They may be from about 2 to 8 cm. in diameter, and either circular, oval, triangular, or much elongated. The septa are very thin and numerous, and the axial cavity is rather shallow. An excellent figure is given by Milne-Edwards and Haime.

Locality.—Shore, Somerset, Cape York.

4. *Euphyllia striata*, Milne-Edwards and Haime.

Euphyllia striata, Milne-Edwards and Haime, Cor., ii. p. 194, pl. D. 2, fig. 1.

A single specimen of this species was obtained. It is very close to the low and stumpy form of *Euphyllia glabrescens*, but the calicles are much larger, more sinuous at the edges, and less frequently divided, and the septa are much more numerous.

Locality.—Shore, Somerset, Cape York.

Genus 5. *Physogyra*, Quelch.

Physogyra, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 293.

Corallum compound, form massive, of very light structure, having the calicles in long sinuous, more or less mæandroid series, with their walls fused throughout so as to form a simple, very thin line of separation between the series. Calicinal centres generally distinct, indicated by the curving of the septa. Costæ almost entirely absent. Epitheca very slightly developed. Septa thin, fragile, very prominent, distant; edge entire. Columella absent. Endotheca well developed, vesicular; the dissepiments continuous between the septa from the centre of the calicle to the wall, very convex above, rather far apart above each other, thus forming wide interseptal chambers. Owing to this great

development of vesiculate endotheca, the series of calicinal centres are separated by wide ridges, formed entirely by the thin wall and by the convex dissepiments which stretch from the centre to this thin wall.

This genus, which has been confounded by Milne-Edwards and Haime with *Plerogyra* will include not only the following species, but also the *Plerogyra lichtensteini* of those authors; the genus *Plerogyra* being limited to those forms in which the walls are not fused throughout so as to form a thin lamina, but in which the series remain distinct with their walls united below and separated above, except occasionally when two free growing ends meet, and grow together.

Physogyra aperta, Quelch (Pl. III. figs. 1–1*a*).

Physogyra aperta, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 294.

Corallum convex above; wall very thin, simple, sometimes almost rudimentary. Costæ very slightly developed, and then only at the margin of the series. The series of the calicinal centres open and shallow, in no part deep and narrow; the centres are often difficult to distinguish, owing to the uniform development of dissepiments along the series. Width of series about 16 mm., but at times more than 20 mm. The septa are from 2 to 4 mm. apart, very thin and very projecting, subequal except at the ends of the series where some are very small, fragile and easily broken away, leaving the vesicular dissepimental ridges almost bare. The dissepiments are thin, convex above, more or less fragile and easily broken away, about 3 mm. apart from those above or below at the wall, closer at their inner terminations, forming simple, wide, curved interseptal chambers.

The species is easily distinguished from the *Physogyra lichtensteini* (Milne-Edwards and Haime) by the nature of the calicinal centres which in that species are very deep and narrow.

Locality.—Banda.

Genus 6. *Pectinia*, Oken.

Pectinia (pars), Oken, Lehrb. der Naturg., i. p. 68.
„ Milne-Edwards and Haime, Cor., ii. p. 206.
„ Duncan, Rev. Madrep., p. 86.

The dissepiments in this genus are stated by Milne-Edwards and Haime to be very abundant, curved and oblique, sometimes simple but more often forming large vesicles. This, however, is misleading, for in the calicinal valleys very little can be seen of endotheca as viewed exteriorly, and it is only at the basal parts, as seen in section, that the endotheca can be made out. In young stages, therefore, no endotheca, or but very slight traces of it at the base, would be present.

Pectinia profunda (Dana).

Ctenophyllia profunda, Dana, Zoophytes, p. 172.

A single specimen was obtained having an elongated narrow form like a young specimen of *Manicina areolata*. It is about 8 cm. long and the sides are very undulate, so that closely approximated, lateral folds are formed, by the fusion of which, during development, the transverse ridges would arise. The pedicel of attachment is very small, and a dense epitheca seems to be present covering the corallum up to nearly 1 cm. from the margin, but this in reality is largely of foreign growth, as of small shells, worm tubes, and calcareous algæ, and must be very variable in different specimens at different localities. The costæ are sharp-edged, dentate, narrow, lamellate, radiating to the pedicel. The septa are thin, of three, four, or five sizes—many septa of higher orders being developed at the curved exterior margins of the series. The columella is lamellate, continuous, and joined at the sides by vermiform processes from the lower edge of the septa. No endotheca is developed as seen in the calicinal valleys from above, but in section rudimentary dissepiments are found at the basal parts of the centres.

The specimen is a young form; and, owing to the absence of the soft parts, and the continuity of the columella, it can only be concluded that the form is a compound one by the extremely sinuous edges of the corallum, through the lateral coalescence of which transverse ridges are already developing. It very closely agrees with the *Sphenophyllia flabellum*, Moseley, so much so as to lead me to think that that form may probably be a young example of the same species. Unfortunately, little or nothing is known of the young stages of any of the species of the genus.

Locality.—St. Thomas, reefs.

Genus 7. *Trachyphyllia*, Milne-Edwards and Haime.

Trachyphyllia, Milne-Edwards and Haime, Cor., ii. p. 340.
„ Duncan, Rev. Madrep., p. 82.

Trachyphyllia amarantus (Dana).

Manicina amarantum, Dana, Zoophytes, p. 189, pl. ix. fig. 1.

The specimens of this species differ not inconsiderably in the size of the calicinal series, in the state of development of the paliform lobe, and in the thickness of the septa, and consequently in the size of the denticulations of the costæ and septa. According to these differences, the specimens are strong and thick or comparatively delicate and thin.

Locality.—Mactan Island, Philippines.

Genus 8. *Mussa*, Oken.

Mussa, (pars), Oken, Lehrb. der Naturg., i. p. 73.
„ Milne-Edwards and Haime, Cor., ii. p. 328.
„ Duncan, Rev. Madrep., p. 82.

Five species of this genus were obtained.

1. *Mussa fistulosa*, Milne-Edwards and Haime.

Mussa fistulosa, Milne-Edwards and Haime, Cor., ii. p. 332, pl. D. 3, fig. 3.

Of this well-marked species a single large specimen was obtained. The septa are very variable in different parts of the specimen, sometimes being very thick and almost swollen, and, not infrequently, quite small and thin. A curious hard and thick styliform columella is formed in one cup, due to the lodgment of foreign matter in the calicle. The depth of the cups is frequently less than 1 cm.

Locality.—Kandavu, Fiji.

2. *Mussa multilobata*, Dana.

Mussa multilobata, Dana, Zoophytes, p. 182, pl. viii. fig. 2.

A single specimen of this species was obtained. In some parts a very strong epitheca is developed, while on others it is quite rudimentary, leaving bare the nearly smooth surface with its striate and rarely spinose costæ. The specimen described by Milne-Edwards and Haime under this name seems to be a different form, more closely allied to the *Mussa echinata* than to this species.

Locality.—Banda.

3. *Mussa echinata*, Milne-Edwards and Haime.

Mussa echinata, Milne-Edwards and Haime, Cor., ii. p. 337.

This species is close to the *Mussa multilobata*, Dana, but is readily distinguished by its very spiny wall, which is often much thickened, and by its more numerous and rather thinner septa. Often the series are very short, and, not infrequently, many calicles become isolated. A strong epitheca is occasionally present on many parts of the colony. The *Mussa multilobata*, Milne-Edwards and Haime, does not seem to be different from this species.

Locality.—Amboina.

4. *Mussa aspera*, Milne-Edwards and Haime.

Mussa aspera, Milne-Edwards and Haime, Cor., ii. p. 332.

The specimen of this species is poorly grown, and by no means presents the typical structure of the species; it is smaller throughout, more vesicular and less thickened. A good figure of the species is given by Milne-Edwards and Haime.[1]

Locality.—Somerset, Cape York, 5 fathoms.

5. *Mussa brueggemanni*, n. sp. (Pl. II. figs. 6–6*b*).

Corallum forming large hemispherical clumps in which the calicles are either isolated and distinctly separate throughout a greater or less portion of their length, or remain united forming rather short sinuous series. The width of the calicinal series is very variable, from 10 mm. to 30 mm., the edge of the calicles being often expanded; the width of the interspaces between the series about 12 mm., the diameter of the isolated calicles often about 30 mm. or more, and the depth about 15 mm., sometimes less. The costæ are often quite distinct, and marked with small spines, which are larger and more numerous near the margin of the calicles, but frequently the outer wall is only obscurely striated or quite smooth. Five cycles of septa are present, easily determined in the isolated calicles, a sixth cycle being quite rudimentary. The septa are thus usually close and crowded; the chief septa are thickened but never stout, very prominent above the edge of the wall, and divided to the very centre into numerous, long, sharp, slightly curved strong teeth, which are thicker and shorter above; the smaller septa are very thin and are furnished with long, narrow, sharp teeth. The columella is generally well developed and trabeculate. Endotheca low down in the cup. In transverse section the septa and dissepiments are seen to be very close and thin, and the wall but slightly thickened.

The species is close to the *Mussa cytherea* and has much of the appearance of a very attenuated form of *Mussa sinuosa*. One small specimen and several fragments were obtained, the fragments being taken from one large specimen which measured more than 5 feet in diameter.

The very closely crowded septa, which are divided throughout even to the very centre into long, sharp, and slender teeth, those towards the outer edge being somewhat enlarged, give a very characteristic appearance to the species and will readily serve to mark it. The species is named after the late Dr. Brüggemann who first recognised its specific distinctness, but did not describe it.

Locality.—Amboina.

[1] *Ann. d. Sci. Nat.*, ser. 3, vol. x. pl. viii. fig. 4.

Genus 9. *Symphyllia*, Milne-Edwards and Haime.

Symphyllia, Milne-Edwards and Haime, Cor., ii. p. 369.

The genera *Symphyllia*, *Isophyllia*, and *Ulophyllia* are accepted as defined by Milne-Edwards and Haime. They are closely related to one another, and to *Mussa* on the one hand and *Tridacophyllia* on the other, but their differences seem sufficiently well marked to rank them as distinct. Very different opinions have been expressed by different writers as to their relationship, and it is certain that in some cases the forms on which these opinions have been based have not been rightfully referred to the genus under which they were placed. It was thus a necessary consequence that the genus under which they were wrongly placed by a misinterpretation of characters, and the genus to which they should have been referred, should not seem distinct, and should therefore have been united.

The numerous species described by Duchassaing and Michelotti from the West Indies, and placed by them under the genus *Symphyllia*, are all forms of *Isophyllia*, and, as Brüggemann has stated, the genus *Symphyllia* is not found in the West Indies.

Pourtalès, keeping *Mussa* distinct, considered that *Symphyllia* and *Isophyllia* were synonymous, and retained *Isophyllia* to include them both.

Verrill, on the other hand, has maintained that *Isophyllia* is distinct from *Symphyllia;* while he has united *Symphyllia* with *Mussa*.

Brüggemann, following Verrill, united *Symphyllia* with *Mussa*, maintaining *Isophyllia* to be distinct from them; he, however, united *Isophyllia* with *Ulophyllia* under the latter name.

Duncan, following Pourtalès, regards *Mussa* and *Symphyllia* as distinct, but unites *Symphyllia* with *Isophyllia* under the former name, *Ulophyllia* remaining distinct.

It seems to me, however, after a careful study of a large number of species of the different genera, that the treatment of these genera given by Milne-Edwards and Haime is an accurate one; and they have therefore been all retained, with their original signification.

The essential distinction of *Symphyllia* from *Mussa* is to be sought in the nature of the wall. In *Mussa* the walls are normally distinct, a condition which, although most clearly seen in those colonies in which the calicles are rapidly isolated, is yet clearly evidenced in the development of the seriate forms in which the walls of the developing series are found to be free from those of neighbouring series. In *Symphyllia*, on the other hand, the walls throughout are simple, those of neighbouring series forming a simple, solid ridge between the valleys, and originating as such in the earliest stages of development.

The opinion that these two genera should be united, seems to have been based on the condition found in such a species as the *Mussa regalis*, Dana, in which the walls of the

series in the more central parts of the colony are found to be united. A careful examination shews, however, that this union is altogether a secondary process, arising not with the original development of the series, but later on, when, by their increase in size, their adjoining edges have been brought into contact at many points and have then coalesced, as it were, for want of space. This process of union can be directly traced in large specimens; and, in these, ample confirmation will be found in the presence of the larger or smaller openings of variable shape which have been left in many places where complete union has not yet taken place between neighbouring series. Towards the central parts of these large specimens, where the union due to this secondary process is most complete, the resulting ridges have all the superficial characters of the normally developed ridges of *Symphyllia*, with the exception that their course is often interrupted by the occurrence of the variable-sized apertures, which in some cases will be found to be extremely small or even on the point of being obliterated. The peripheral portions of all such colonies, moreover, shew clearly the normal *Mussa* growth.

The characters which separate *Isophyllia*, are discussed under that genus.

Two species of *Symphyllia* are in the collection.

1. *Symphyllia sinuosa* (Quoy and Gaimard).

Mæandrina sinuosa, Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 227, pl. xviii. figs. 4, 5.
Symphyllia sinuosa, Milne-Edwards and Haime, Ann. d. Sci. Nat., ser. 3, vol. x., pl. viii. fig. 7.

Two small fragments were collected which seem referable to this species. The corallum is rather light and cellular, and the ridges are narrower and less rounded than is common in the species.

Locality.—Samboangan, Philippines.

2. *Symphyllia acuta*, n. sp. (Pl. II. figs. 5–5*b*).

Corallum with the upper surface more or less flattened; costæ on the lower surface narrow and thin, denticulate. Walls simple throughout, leaving no furrow above, never much thickened, being about 2·5 to 3 mm. wide in a transverse section of the corallum. Calicinal series very irregular, often nearly straight, generally sinuous; two or more centres often placed in the breadth of the same valley, but always opposite the point of development of new ridges where the valleys are very wide. Width of the valleys from 15 to 20 mm., depth from 10 to 15 mm. The ridges are very uniformly angular, broad below, and becoming quite narrow and acute above, never broad and rounded. Septa narrow, rather thin, numerous, and closely placed, from 12 to 15 per centimetre, generally alternately large and small, with unequally small and sharp teeth which are somewhat thicker and longer at the upper part, but never become large and stout. Columella

very small, trabeculate. Endotheca low down in the cup, very abundant; dissepiments very thin.

This species resembles *Symphyllia agaricia* in many of its characters, but differs considerably in the width and depth of the vallêys and in the size and number of its septa. The characters of its septa will readily distinguish it from *Symphyllia radians*.

A small broken specimen was collected.

Locality.—Banda.

Genus 10. *Isophyllia*, Milne-Edwards and Haime.

Isophyllia, Milne-Edwards and Haime, Cor., ii. p. 374.

Some of the opinions which have been held as to the affinities of this genus by different authors have been noticed under *Symphyllia*.

The genus is essentially separated from *Symphyllia* by the characters of its septa. In *Symphyllia* the septa are strictly of the type of *Mussa*, being very thin near the centre of the calicle and increasing in thickness outwards, till at the margin they are very thick; and correspondingly the teeth of the septa are very thick and long at the margin, becoming very thin and small or rudimentary within. In *Isophyllia*, on the other hand, the septa are subequal within and without, being never markedly and distinctly thickened at the margin of the calicle, although very prominent; while correspondingly the teeth are subequal throughout, and do not take on the *Mussa* type.

Eight species of the genus were collected.

1. *Isophyllia strigosa* (Duchassaing and Michelotti).

Symphyllia strigosa, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 70, pl. x. fig. 16.

A large and fine series of specimens of this species was obtained. Many of the specimens are very small and show somewhat irregularly the six lobes into which the simple calicle becomes at first divided, while others attain to a size of 12 cm. in diameter. They are nearly hemispherical, sometimes slightly concave at the base, with an epitheca unequally developed; the walls are wholly fused and thin, sometimes marked with a very narrow furrow above; the costæ on the outer wall are generally well developed, lamellar and spinulose; the calicles may be isolated or in series of from two to six centres, being from 15 to 25 mm. wide, and from 10 to 16 mm. deep; the septa are very thin in the young specimen, becoming thicker and more exsert in older ones; they are perpendicular or nearly so, more or less truncate and wide above and bear throughout their whole length subequal, long, acute teeth, which give a bristling appearance to the corallum; the columella is well developed; and the number of septa to the centimetre is very variable even in the same specimen, being from seven to thirteen according as the last cycle is developed or not.

The specimens which I have referred to this species present some very interesting variations, but there are no differences constant enough in them to warrant specific separation. At least two of them in the absence of the others would seem to be distinct, but with the others at hand it is impossible so to designate them, for the series presents almost every intermediate condition, while the characters are extremely variable—the least variable being that the border of the septa is approximately vertical and the upper portion more or less truncate.

Thus the corallum may be very convex and raised, or slightly convex and broad, with a diameter of about 12 cm.; the epitheca very rudimentary or more developed; the costæ very finely spinulose or unequally toothed; the wall very thin, or thick enough to show a small furrow above; the calicles separate, or in series straight or sinuous, scarcely or nearly separated, deep or comparatively shallow, wide or narrow; the septa thin or thickened, with long or short teeth, very close or rather far apart according to the greater or less development of the last cycle; and the columella slightly or much developed; while at the same time these differences are most irregularly marked on different specimens.

Three forms may be selected as showing the extremes of variation :—

a. One with a very regularly raised, convex corallum; thin walls; rather large and deep calicles in sinuous series of from two to six centres; thin, vertical and truncate septa; very sharp, long and rough teeth giving a jagged appearance to the calicle; columella well developed.

b. Another with a very raised, convex, somewhat oblong corallum; thick walls; large, deep calicles in nearly straight series with scarcely distinct centres; thick, scarcely vertical and truncate septa; sharp and rough teeth; columella well developed.

c. A third with a very broadly convex corallum; thin walls; small, shallow calicles, separate or tending to be so; thin, rather narrow septa, somewhat vertical and truncate; short, sharp and rather small teeth, and a slightly developed columella.

The *Symphyllia anemone*, Duchassaing and Michelotti, must, I think, be placed as a synonym of this species, and perhaps also the *Symphyllia aglæ*. The *Isophyllia rigida*, Verrill, as re-described by Pourtalès under *Isophyllia guadulpensis* seems also to be indistinguishable from the broad variety of the species. The *Madrepora lactuca*, Esper,[1] seems to be the above species, but I have taken the name of the later authors to avoid ambiguity and doubtful identification.

Locality.—Bermuda.

[1] Pflanz. Forts., i. Tab. xxxiii.

2. *Isophyllia fragilis* (Dana).

Mussa fragilis, Dana, Zoophytes, p. 185, pl. viii. fig. 7.

This species has been referred to the genus *Colpophyllia* by Milne-Edwards and Haime, but it has all the fundamental characters of *Isophyllia*, under which it has been placed by Verrill,[1] and it is close to the *Isophyllia strigosa* on the one hand and the *Isophyllia cylindrica* on the other.

It is peculiar in the form of the upper parts of the wall, which, in neighbouring cups remain distinct as two subparallel lines, the septa passing over and coalescing between them. The costæ are sublamellate and entire or very finely denticulate. The septa are thin, fragile, not perpendicular at the edge, very unequal, and prominent and rather distant; the teeth are long, fine, ragged, and irregular. The columella is generally very abundant and loosely trabeculate, and continued from centre to centre.

A single small specimen was obtained. The form figured as *Isophyllia dipsacea* in the Report on the Florida Reefs, plate vii. fig. 3, seems, from general appearance, to be a typical specimen of the species, although the details of the structure of the wall are not shown.

Locality.—Bermuda.

3. *Isophyllia australis*, Milne-Edwards and Haime.

Isophyllia australis, Milne-Edwards and Haime, Cor., ii. p. 375.

Of this species, the type of which is in the Paris Museum, two specimens were obtained, one of which is much abraded at the centre and on one side, and bears upon it a young form consisting of a single calicle, clearly of the same species. The corallum in this species is but slightly convex; the costæ are decidedly lamellate and delicately spinulose, very apparent beneath the rudimentary epitheca; the walls are simple and fused throughout; the septa though strong are thin and close, and the teeth are long and generally fine. The number of the septa to the centimetre is very variable according to the development of the last cycle, and may be from seven to twelve.

Locality.—Bermuda.

4. *Isophyllia dipsacea* (Dana).

Mussa dipsacea, Dana, Zoophytes, p. 184.

Of this species there are many specimens in the collection. Drawings of the species are given in the plates of the Florida Corals,[2] but I believe that the specimen figured on plate vii. fig. 3, is referable to *Isophyllia fragilis*, Dana, and not to the present species.

The specimens obtained can be somewhat approximately arranged in a series, of which the extremes are so far removed, that in absence of the intermediate ones, two

[1] Dana, Coral and Coral Islands, p. 328.

[2] *Mem. Mus. Comp. Zoöl.*, vol. vii. No. 1.

specific names would doubtless be applied to them. The very convex specimens of the typical form gradually pass to those with a much broader growth, which seem to be very close to, if not identical with, the *Isophyllia sinuosa*, Verrill. In these the convexity is very slightly marked, and the cells become more shallow and open and of smaller size, though this is very variable (1·5 to 3·5 cm.), while at the same time the septa are thinner. The slight furrow on the wall between the septa often becomes somewhat prominent, and marks an approach to *Isophyllia marginata* (Duchassaing and Michelotti). The columella in some is well developed, and in others rudimentary.

An interesting variety occurs in which many of the larger septa are much thickened, a variety that calls to mind the *Isophyllia cylindrica*, to which it is closely allied.

The *Symphyllia thomasiana*, Duchassaing and Michelotti, does not seem to differ in any respect from the present species.

Professor Moseley remarks that this species seems to thrive best in the shade.[1]

Locality.—Bermuda.

5. *Isophyllia marginata* (Duchassaing and Michelotti).

Symphyllia marginata, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 72.

This specimen, which is shortly pedunculate, differs from the description of Duchassaing and Michelotti in one chief particular, namely, that the columella is here but slightly developed, a character that would place it very close to the *Isophyllia helianthus* of those authors. It is very close to the *Isophyllia dipsacea*.

On one side the epitheca is fairly well developed, on the other scarcely present; the walls are always fused together up to the edge of the calicles, but flattened above and wide enough to leave a well-marked vacant space or furrow between the septa of adjoining calicles; the septa are rather exsert, thin and finely dentate; the calicles are rather small and shallow, with measurements somewhat larger than those given in the description; the number of the septa to the centimetre is very variable in different parts according to the presence or absence of the septa of the last cycle.

To this species I have referred, with some doubt, another specimen which is much more convex than the foregoing, with an irregularly developed epitheca, a more abundant columella, and thicker and rougher septa. It closely agrees with it, however, in the flattened wall of the series which gives the characteristic appearance to the species, and as the above differences are all in characters which are very variable in the same species, it seems justifiable to conclude that a larger collection of this species would yield forms with less divergence.

To this species also, it is likely, should be referred the *Isophyllia multilamella* described by Pourtalès in the Florida Reef-Corals,[2] of which the *Lithophyllia multilamella*, Duchassaing and Michelotti, seems to be only a young specimen.

[1] Notes by a Naturalist on the Challenger, p. 27.

[2] Illustr. Cat. Mus. Comp. Zoöl., No. iv.

Duchassaing and Michelotti have regarded this species as being closely allied to *Symphyllia grandis*, Milne-Edwards and Haime, but a comparison of the description of this species with that of *Symphyllia grandis* will shew that the two forms are quite distinct, and not referable to the same genus.

Locality.—Bermuda.

6. *Isophyllia cylindrica* (Duchassaing and Michelotti).

Symphyllia cylindrica, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 71.

A very fine series of specimens, apparently referable to this species, was obtained. The series shows clearly the different stages of growth, five specimens being simple, fixed forms, the youngest of which is about 5 mm. in diameter, circular, with very prominent septa and costæ and a rudimentary wall, with three cycles complete; and the oldest about 2 cm. in diameter with five cycles complete, slightly oval in shape, irregular on one side where gemmation is taking place. Another small specimen shews an advanced stage in the formation of the colony, there being two fully formed calicles and a third developing. The larger specimens are elongated and broadly pedunculate; on these an incomplete epitheca is present, and the walls are fused throughout but often flattened above, presenting a decided approach to *Isophyllia marginata*. The calicles tend to isolate themselves, but are generally in irregular series of from two to four. The septa are of very variable size, and generally much thickened, more especially the primaries and secondaries (more clearly seen in the young stages); the teeth are strong but not specially developed at the upper margin. There are about seven or eight large septa to the centimetre with often one or two very small additional ones. The columella is moderately developed, but not abundant, and not continued from centre to centre. The width of the calicles is about 20 mm. and the depth from about 8 to 10 mm.

A single rather small specimen, which does not seem distinct from this species, differs in being flattened, apparently free at the base, and in having thinner septa. The species is very close both to the *Isophyllia dipsacea* and to *Isophyllia marginata*, and there are a few forms which seem so nearly intermediate between them, that it is with much doubt that I have retained the species.

Locality.—Bermuda.

7. *Isophyllia knoxi* (Duchassaing and Michelotti).

Symphyllia knoxi, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 71.

This specimen agrees well with the description given by Duchassaing and Michelotti. The most striking feature is the degree of separation of the calicles, which tend rapidly to

isolate themselves. This is, however, very irregular. In certain parts, especially towards the outer portion of the corallum, the edges of the calicles are quite free, the fusion of the walls taking place about 5 mm. below the edge of the calicle, thus leaving a well-marked, rather deep furrow, which is more or less distinctly marked by subspinulose costæ; but towards the centre the fusion of the walls is often complete, and but a slight furrow is present between the septa from adjacent calicles. The size of the calicles is very variable, being from 3 to 4 cm. wide and from 1 to 1·5 cm. deep. The septa are unequal and thick, eight or nine to 1 cm., but smaller intermediate ones are often present. The teeth are much more marked at the middle part of the septa, becoming smaller near the edge of the calicle, and somewhat so near the columella. This last is always well developed.

The corallum in this specimen is somewhat turbinate, about 8 cm. high, 12 cm. long, and 9 cm. broad. A well-developed epitheca is present, rising to from 3 to 8 mm. from the border. The costæ are well marked near the calicles, and are subspinose.

Locality.—Bermuda.

8. *Isophyllia aspera* (Duchassaing and Michelotti).

Symphyllia aspera, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 71.

The specimen which I have referred to this species agrees in every respect with the short description as given by Duchassaing and Michelotti, and seems to be quite distinct from those obtained at Bermuda. The calicles are sometimes separate, but are more frequently in long and sinuous series, which contain from two to fifteen calicinal centres. These centres are easily distinguished by the thickening of the columella at these points and by the great development of pairs of opposite septa which enclose them. The calicinal valleys are rather shallow, being from about 7 to 10 mm. deep. The walls are strong and thick, marked with a small furrow between the septa of opposite sides, but not flattened at the top, their width is very variable, ranging from 15 to 30 mm., the greatest width being generally that of a terminal calicle of a series. The septa are prominent, nearly subequal, generally much inclined, but sometimes nearly perpendicular at their outer edges, with few, from four to seven, strong unequal teeth.

The specimen is a very large one, being about 15 cm. in diameter. A large portion of it has grown under unfavourable conditions, and the wall at that part has become less elevated, thicker and broader, the septa much less prominent and thicker, with shorter, more rounded, and almost suppressed teeth. On comparison with this portion of the specimen, it would seem that the *Symphyllia conferta*, Duchassaing and Michelotti, is but a variety of this species.

Locality.—St. Thomas, West Indies.

Genus 11. *Ulophyllia*, Milne-Edwards and Haime.

Ulophyllia, Milne-Edwards and Haime, Cor., ii. p. 377.

The genus *Ulophyllia* is distinguished from *Isophyllia* by the nature of the walls and septa. The walls are always thin, more especially at their upper portion, where they are often broken through. The septa, though prominent about the centre of the calicles, where they generally give rise to a more or less distinct, paliform lobe, are very narrow on the upper part of the wall, and often take the form of thickened striations, and on this part of the septa the teeth are reduced to very fine serrations or are quite absent. The ridges which are thus formed are very narrow and sharp at their upper part, and differ altogether from those formed by the thickened wall and prominent septa of *Isophyllia*.

The genus is very closely allied to *Tridacophyllia*, but is distinguished by the greater thickness and the less elevation of its walls, by the much greater distinctness and prominence of its septa, and by the fact that the calicinal centres are confined to the valleys, and are not found also on the basal parts of the high ridges as in *Tridacophyllia*.

Two species of the genus were collected.

1. *Ulophyllia aspera*, n. sp. (Pl. III. figs. 5–5*b*).

Corallum convex or flattened, covered up to the edge by a very thin epitheca, beneath which the finely denticulate costæ are very distinctly seen. Calicles very frequently isolated, but often arranged in small series, which very rarely have as many as five or six centres; the single calicles are from 15 to 25 mm. wide in their long diameter, oval, elongated or irregular; the calicles in series are separated from each other by large and strong septa, which meet from opposite sides of the valley, and are bordered by wide interseptal spaces. The width of the series is from 11 to 15 mm., and the depth from 8 to 12 mm. The walls are thin above and often broken through, with a very ragged appearance due to the projection of opposite septa above, thick and very strong below. The septa are of five cycles, the last cycle being incomplete in many orders, closely placed and unequal, often quite thin, especially in the shallower calicles, prominent below so as to form a broad, denticulate, paliform lobe, and rather prominent above with fine, unequal, and strong teeth. There are about eight septa to the centimetre along the series, but on the outer part of the corallum they are more numerous, often as many as fourteen. Columella very abundantly developed, of open trabeculate or closely interlaced tissue. Endotheca slight, seldom forming vesicular ridges; and then but very slightly developed and irregularly placed.

A large specimen of this species, about 16 cm. in diameter, was obtained. Owing to

the slight endotheca, the interseptal spaces are very deep and conspicuous around the porous mass of the columella.

Locality.—Banda.

2. *Ulophyllia cellulosa*, n. sp. (Pl. III. figs. 6–6*c*).

Corallum convex above, flattened below, destitute of an epitheca, strongly and denticulately costate, with the intercostal spaces very abundantly and largely vesicular. Calicles sometimes placed singly, but generally arranged in long sinuous valleys in which the centres are very distinct, and always separated by the meeting of two large septa from opposite sides of the valley. Width of the valleys from 15 to 30 mm., depth often as much as 20 mm. Walls very thin, often broken through, much more raised at the central than at the outer part of the corallum where the cups are broad and shallow. Septa unequal, of four cycles, thin, very prominent below, and forming a distinct, central depression for the columella; much less prominent above and giving the ridges an acute edge, unevenly and rather far apart, being about six or eight to the centimetre on the top of the ridges, much more numerous and unequal in the outer and shallower cups, where there are often as many as thirteen to the centimetre; teeth of the septa rather large below, becoming very small or absent above, never becoming long and narrow, or bifurcating; a paliform lobe generally marked. Columella generally well developed, forming a rather large porous or trabeculate mass, but frequently scanty. Endotheca very abundantly developed as large, long, regularly placed, interseptal vesicles, which give a very swollen, convex appearance to the ridges at their lower portion and for some distance above the position of the columella, equal to about half the height of the ridges, the wall being continued above this swollen portion as a narrow lamina.

In appearance the single specimen in the collection has a general resemblance to the figure of *Madrepora lactuca*, Esper.[1] This species is easily separated from the *Ulophyllia aspera* by the abundantly developed endotheca which here gives rise to a swollen, raised ridge between the valleys in which the centres are placed. This ridge, formed by the large dissepiments between the septa, is more clearly seen when the prominent septa are broken away. A transverse section of the ridge to the level of the columella shows the thin wall with opposite septa, on the lateral surfaces of which are the thin interseptal dissepiments, which form long, curved chambers, and which extend above the columella for about one-half the height of the ridge. Other characters which serve to separate it from the same species are the much thinner walls; the wider, deeper, and more continuous valleys in which the centres are placed; their regularly and less sharply toothed septa; the more scanty columella; and the absence of a distinct epitheca on the vesicular costæ.

Locality.—Banda.

[1] Pflanz., Madrep., Tab. xxxa.

Genus 12. *Tridacophyllia*, Blainville.

Tridacophyllia, Blainville, Dict. d. Sci. Nat., lx. p. 327.
„ Milne-Edwards and Haime, Cor., ii. p. 380.
„ Duncan, Rev. Madrep., p. 94.

Tridacophyllia manicina, Dana.

Madrepora lactuca, Ellis and Solander (*non* Pallas), Zoophytes, p. 158, pl. xliv.
Tridacophyllia manicina, Dana, Zoophytes, p. 196.

The figure given by Ellis is a very good one, and will serve easily to identify the species. The walls are very unequally interrupted, often much broken through, and at other times quite continuous. Some fine specimens were obtained, and also a few pieces. The species is common in the East Indies but does not occur in the West Indies.

Localities.—Amboina; Ternate; Banda.

Genus 13. *Diploria*, Milne-Edwards and Haime.

Diploria, Milne-Edwards and Haime, Cor., ii. p. 401.
„ Duncan, Rev. Madrep., p. 87.

Diploria cerebriformis (Lamarck).

Meandrina cerebriformis, Lamarck, Hist. Anim. sans Vert., ii. p. 246, 1816.
Diploria cerebriformis, Milne-Edwards and Haime, Cor., ii. p. 402.

Of this very common species only a single, rather small specimen was obtained. It is about 15 cm. in diameter at the base, and about 9 cm. high. Professor Moseley remarks that it appears to prefer to grow where the water is lighted up by sunshine, and is conspicuous at the bottom as a bright yellow mass.[1]

Locality.—Bermuda.

Genus 14. *Manicina*, Ehrenberg.

Manicina, Ehrenberg, Cor. roth. Meer., p. 101.
„ Milne-Edwards and Haime, Cor., ii. p. 397.
„ Duncan, Rev. Madrep., p. 88.

Manicina areolata (Linnæus).

Madrepora areolata, Linnæus, Syst. Nat., ed. 12, p. 1272.
Manicina areolata, Milne-Edwards and Haime, Cor., ii. p. 398.

Milne-Edwards and Haime state that the septa are about fifteen to the centimetre and that there seem to be three cycles developed, but there are often as many as twenty

[1] Notes by a Naturalist on the Challenger, p. 27.

to the centimetre according to the development of a fourth cycle. Pourtalès, who had ample opportunity of examining numerous specimens in every stage of development, was of opinion that there was but one species of the genus to be found in the West Indian fauna.[1] Excellent figures are given in the Report on the Florida Reefs, plates v., vi.

Localities.—(1) St. Thomas, West Indies. A single specimen from shallow water on the reefs.

(2) Simon's Bay, Cape of Good Hope. A single specimen from 10 to 20 fathoms.

Genus 15. *Mæandrina*, Lamarck.

Meandrina, Lamarck, Hist. Anim. sans Vert., ii. p. 244, 1816.
Mæandrina, Milne-Edwards and Haime, Cor., ii. p. 388.
„ Duncan, Rev. Madrep., p. 88.

Three species of this genus were obtained.

1. *Mæandrina labyrinthica* (Ellis and Solander).

Madrepora labyrinthica, Ellis and Solander, Zoophytes, p. 160, pl. xlvi. figs. 3, 4.
Mæandrina labyrinthica, Dana, Zoophytes, p. 256, pl. xiv. fig. 1.

A single almost hemispherical specimen, about 14 cm. in diameter, was obtained. The ridges are rounded, sometimes slightly truncate, with a slight furrow. The walls are very thick and hard; the septa are rather thick and very broad, nearly meeting those of opposite sides at the bottom of the gyri, and rarely marked with a paliform lobe; at distances of from 3 to 5 mm. along the gyri, paired opposite septa enlarge slightly and apparently separate the calicinal centres. The columella is narrow, subporous or trabeculate. The width of the gyri is from about 7 to 9 mm. and the depth from about 5 to 6 mm.

Apparently the species is subject to great variation, the ridges becoming more or less triangular, the columella abundant, and the paliform lobes distinct.

Very good drawings of the species are given in the Report on the Florida Reefs, plate ix. figs. 10 to 12.

Locality.—Bermuda.

2. *Mæandrina sinuosissima*, Milne-Edwards and Haime.

Mæandrina sinuosissima, Milne-Edwards and Haime, Cor., ii. p. 393.

A single small specimen of this species was obtained. It is attached to the under side of the "form *f*" of *Mæandrina strigosa*, a species to which it is very closely allied, and

[1] See Pourtalès, Deep-Sea Corals, pp. 72 and 73, where much interesting information will be found.

of which it may prove to be simply a very thick and hard triangular-walled variety. At the outer part of the corallum the ridges are rounded and much damaged.

Locality.—Bermuda.

3. *Mæandrina strigosa*, Dana.

Mæandrina strigosa, Dana, Zoophytes, p. 257, pl. xiv. fig. 4.

A most interesting series of twenty-nine specimens of this species was obtained. They are of all sizes from about 10 cm. in diameter to more than 30 cm., the largest being about 18 cm. high. They are either hemispherical, subglobose or broadly convex, oblong or reniform—the hemispherical being the prevailing form. The species is subject to very great variation, and there are at least three forms which, in the absence of the other intermediate ones, might have been considered distinct. Pourtalès has already pointed out this variability as seen in two of the Florida forms; one with rather narrow gyri, thin walls, paliform lobes distinct but not very prominent; the other with wider gyri, wall rather thick, sometimes flattened and slightly furrowed on the top, and paliform lobes very distinct. This second form had previously been referred by Verrill to *Mæandrina sinuosa*, Lesueur.

While it is possible to select five or six specimens from the series as being more or less distinct, it is advisable to remark that the characters by which they may be distinguished are extremely variable, as shown by other specimens, and even by the same specimen at the outer part of the corallum. The following five forms may be described in order to bring more prominently forward the great modification which the species may undergo:—

a. Gyri very deep, about 7·5 mm., with a width of from 6 to 8 mm.; walls thick; septa with free border vertical, paliform lobes very distinct, rather thick; width of ridges above the paliform lobes from about 4 to 5 mm.; columella very abundant, forming a continuous mass about 2·5 mm. wide.

b. Gyri very deep, about 7 mm., with a width of 6 mm.; walls very thin; septa with free border vertical, paliform lobes very distinct and thin; width of ridges above the paliform lobes about 3 mm.; columella very abundant, forming a continuous mass about 2·5 mm. wide.

c. Gyri rather deep, from about 5 to 6 mm., with a width of from 4 to 5 mm.; walls very thin; septa with free border vertical, paliform lobes very distinct, those of opposite sides almost meeting and hiding the columella, so as to give a shallow appearance to the valleys, but often widening out at very close distances for the calicinal centres, which at the sharp curves of the ridges are quite distinct; width of ridges above the paliform lobes about 3 mm., columella abundant, almost hidden by the paliform lobes.

d. Gyri of variable depth according to the projection of the lamellate columella, from about 3·5 to 6 mm., with a width of from 4·5 to 6·5 mm.; walls rather thick; septa with the free border nearly vertical, but more rounded than in the previous forms; paliform lobes scarcely represented except in a few septa from about 3 to 5 mm. apart, which become very projecting, so as almost to meet from opposite sides; width of ridges from about 4 to 5 mm.; columella not abundant, forming but a raised lamella with prolongations from the septa.

e. Gyri shallow, from about 3 to 4 mm., with a width of from 5 to 7·5 mm.; walls thick; septa with the free edge rounded from the edge of the wall to the paliform lobe; paliform lobes very distinct, more so than in all the others, almost meeting in the centre; width of ridges above the lobes very variable, from 4 to 5·6 mm.; columella not abundant, being a simple lamella more or less pressed upon by the paliform lobes, sometimes widening out and distinct at the sharp curves of the gyri where the calicinal centres are distinct.

Between these forms, which are apparently so distinct, there seems to be almost every intermediate combination of characters, and the width and depth of the gyri, the thickness of the wall, the nature of the septa, the development of the paliform lobe, the thickness of the ridge, and the structure of the columella are seen to be extremely variable and irregularly grouped in their combinations. One and the same specimen often presents marked differences in structure between its central and its basal parts; and the smaller specimens generally agree more closely with the basal than with the central portion of the larger ones.

One special variation in the direction of the gyri may be mentioned as exhibited most clearly in one specimen, which may be distinguished as "form *f*."

f. This form shows gyri which are nearly straight and parallel for distances of from 4 to 6 cm., and the ridges pass off on each side of a central, nearly straight, line almost like the veins in a leaf, curving very slightly to the outer part where they become sinuous. These nearly straight ridges are sometimes excessively thin, passing gradually into the outer thicker and stronger ones. The width of the gyri is from 4 to 8 mm., and the depth from about 4 to 6 mm.

The *Mæandrina serrata*, *Mæandrina crassa*, and *Mæandrina heterogyra*, of Milne-Edwards and Haime, do not seem to be distinguishable from varieties of this species. The *Mæandrina heterogyra* is clearly identical with the "form *f*;" the *Mæandrina crassa* corresponds with "form *e*," and is represented more or less closely on the outer parts of nearly all the varieties of the species; while the *Mæandrina serrata* takes its place in the series between "forms *a* and *b*" and "form *e*."

The species is very close to the *Mæandrina labyrinthica*, which it much resembles

in the broad ridged varieties. Very good figures of the species are given in the Report on the Florida Reefs, plate ix. figs. 6 to 9, but they have been taken from a variety in which the ridges are more or less triangular, an approach to which is present in "form *f*."

Locality.—Bermuda.

Genus 16. *Cœloria*, Milne-Edwards and Haime.

Cœloria, Milne-Edwards and Haime, Cor., ii. p. 411.
„ (subgenus), Duncan, Rev. Madrep., p. 89.

Cœloria has been considered a subgenus of *Mæandrina* by Professor Duncan, but, as defined and limited by him, it seems to me sufficiently characterised to rank as a distinct genus.

Four species of the genus were collected.

1. *Cœloria dædalina* (Dana).

Astræa dædalina, Dana, Zoophytes, p. 236, pl. xii. fig. 7.
Cœloria dædalina, Verrill, in Dana, Coral and Coral Islands, p. 329.

This species is very close to *Cœloria esperi*, which will most likely have to be united with it. It seems to be distinguished by its thicker, rougher, and more uneven septa, and by its shorter calicinal series, but these are very variable characters. In not a few parts of the corallum all the calicles are in very short series or single, and take on a very distinct astræiform appearance.

Two specimens were collected.

Localities.—Kandavu and other reefs, Fiji.

2. *Cœloria esperi*, Milne-Edwards and Haime.

Cœloria esperi, Milne-Edwards and Haime, Cor., ii. p. 417.
„ „ Klunzinger, Cor. roth. Meer., iii. pl. ii. fig. 6.

A broken specimen in the collection shows well the characters of this species. The wall is not vesicular but solid, often becoming slightly swollen towards the outer part of the colony.

Locality.—Kandavu.

3. *Cœloria stricta*, Milne-Edwards and Haime.

Cœloria stricta, Milne-Edwards and Haime, Cor., ii. p. 417.

A small specimen of this species was obtained. The depth of the calicinal valleys in many parts of the corallum is often much less than their width.

Locality.—Kandavu.

4. *Cœloria leptoticha*, Klunzinger.

Cœloria leptoticha, Klunzinger, Cor. roth. Meer., iii. p. 19, pl. ii. fig. 7.

A very large specimen in the collection differs from the description given by Klunzinger only in having a well-developed columella. The calicinal series are usually long and sinuous, but many single calicles are scattered among them. The wide and deep interseptal spaces on each side of the columella are very conspicuous. The walls are often broken through and are at times vesicular.

The *Cœloria spongiosa* (Dana) from the West Indies (?) is close to this species and appears to be distinguished only by the greater width and depth of the valleys.

Locality.—Tongatabu.

Genus 17. *Hydnophora*, Fischer.

Hydnophora, Milne-Edwards and Haime, Cor., ii. p. 418.
„ Duncan, Rev. Madrep., p. 97.

This name was apparently first applied to this genus by Fischer de Waldheim.[1]

Three species were obtained.

1. *Hydnophora microcona* (Lamarck).

Monticularia microconus, Lamarck, Hist. Anim. sans Vert., ii. p. 251, 1816.
Hydnophora microcona, Milne-Edwards and Haime, Cor., ii. p. 423

Several specimens of this common species were obtained.

On many parts of one and the same specimen there are considerable differences in the size and number of the septa, and also in the height and thickness of the monticules, which are sometimes swollen at the apex.

Localities.—Kandavu and other reefs, Fiji.

2. *Hydnophora demidoffi*, Fischer.

Hydnophora demidoffi, Fischer, Mus. Demidoff, iii. p. 295, pl. iv.
„ „ Fischer, Oryct. du Gouvern. de Moscou, p. 156, pl. xxxii.

The reference to the former work quoted is given by Fischer in the second, in which there is a very good figure of the species.

The specimen in the collection is a small one, and it has grown incrusting as a thin lamina over a foreign body. Its margin is free to a greater or less extent, but is not turned up. The little cones are much elevated, angular and sharp.

Locality.—Banda.

[1] See Milne-Edwards and Haime, *loc. cit.*

3. *Hydnophora tenella*, n. sp. (Pl. V. figs. 8–8*a*).

Corallum extremely thin, forming irregularly bent and undulate plates, which are neither incrusting nor thickened at the middle, nor lobate above. The under surface irregularly costate, being finely striated and furnished with a thin epitheca. On the upper more flattened surface the calicinal centres are generally very distinct, but become much less so on those parts which are bent downwards. Where the centres are distinct the septa are of three cycles, the last being incomplete, and the little cones or monticules are very low and broad, and almost rounded, having the septa which traverse them narrow and far apart, with wide vesicular interseptal chambers, formed by numerous well-developed dissepiments. At the centre of the calicles and in the valleys the septa are coarsely granulated, and give the appearance of a well-developed columella. The monticules may be conical or much elongated; and towards the margin they become sharp, angular, and rather narrow, and much more elevated than at the central portion of the colony. At the central portions the calicles in the same series are from about 4 to 5 mm. apart; the width of the monticules being from about 5 to 6 mm., and the height from 1 to 2 mm.

A single specimen was obtained.

The species is close both to the *Hydnophora exesa* and *Hydnophora demidoffi*, but is distinguishable by the free, contorted, thin, explanate habit, by the nature of the calicinal centres which are more clearly astræiform than in any other species of the genus, and by the wide, flattened and vesicular monticules.

Locality.—Samboangan, Philippines.

Genus 18. *Astræa*, Lamarck.

Astræa, Lamarck, Syst. Anim. sans Vert., p. 371, 1801.
Favia, Milne-Edwards and Haime, Cor., ii. p. 426.
„ Duncan, Rev. Madrep., p. 100.

Following Verrill, I have retained for this group Lamarck's *Astræa*, which undoubtedly claims priority over the *Favia* of Oken. The type of Lamarck, for which the name *Astræa* should have been retained, was the *Astræa rotulosa* of his first section and not the *Astræa* (*Siderastræa*) *galaxea* of the second, to which Oken applied it.

Ten species are in the collection.

1. *Astræa fragilis*, Dana.

Astræa fragilis, Dana, Zoophytes, p. 230, pl. xii. fig. 2.

This species is widely separated from the *Astræa dipsacea*, to which Dana had likened it, and which has since been referred by Verrill to the genus *Acanthastræa*.

The trabeculate columella is often very small, situated at the bottom of a narrow central depression, surrounded by the paliform lobes.

Locality.—Mactan Island, Philippines.

2. *Astræa pandanus*, Dana.

Astræa pandanus, Dana, Zoophytes, p. 222, pl. xi. fig. 2.

The specimen in the collection is small and convex. The calicles are remote at the outer part of the colony, with a broad furrow; the septa are of four cycles, the third being very small and narrow, and the fourth quite rudimentary, and represented generally only by one order; the paliform lobes are more or less distinct and acute.

Locality.—Banda.

3. *Astræa versipora*, Dana.

Astræa versipora, Dana, Zoophytes, p. 233, pl. xii. fig. 5.

At the central part of the corallum the cells are often incompletely sulcate, and the ridges quite narrow; the paliform lobes are very indistinctly marked and often absent; the septa are quite thin within, very unequal and thickened at the wall, and rough and raggedly exsert. A single specimen was obtained.

The *Astræa versipora*, originally described by Lamarck, is referable to the genus *Plesiastræa;* but it seems advisable to retain the name given by Dana to this present form, even though his identification of it with that of Lamarck was at fault, since it belongs to a genus different from that of the original description.

Locality.—Kandavu, Fiji.

4. *Astræa danæ* (Milne-Edwards and Haime).

Astræa porcata, Dana, Zoophytes, p. 226, pl. xi. fig. 5.
Favia danæ, Milne-Edwards and Haime, Cor., ii. p. 442.
Astræa danæ, Verrill, in Dana, Cor. and Cor. Islands, p. 329.

The intercalicinal spaces are much broader and more distinctly sulcate at the outer part of the corallum than within. The cups are often elongated and irregular.

A single small specimen was obtained.

Locality.—Reefs, Fiji.

5. *Astræa ordinata*, Verrill.

Astræa ordinata, Verrill, Proc. Essex Inst., vol. v. pt. 3, p. 34.

A single small specimen is referable to this species. As Verrill observes, it is closely allied to the *Astræa speciosa*, Dana, but seems sufficiently distinguished by its firmer

and less cellular structure, by its more distant and even cells, and by its thicker septa and costæ, which have finer denticulations.

Locality.—Mactan Island, Philippines.

6. *Astræa doreyensis* (Milne-Edwards and Haime).

Favia doreyensis, Milne-Edwards and Haime, Cor., ii. p. 432.

The unequally raised edges of the calicles and the broad ridges give a peculiar appearance to this species, which is thus easily distinguished from the *Astræa denticulata*, with which it has many points of resemblance. The calicles in which division is taking place, or is about to take place, are much elongated and often irregular, with a diameter of from about 10 to 12 mm.

Locality.—Banda.

7. *Astræa speciosa*, Dana.

Astræa speciosa, Dana, Zoophytes, p. 220, pl. xi. fig. 1.

A portion of a large specimen was obtained. Owing to the very light structure of the species, the upper portions of the exsert septa are often broken away, a somewhat ragged appearance resulting. I have followed Studer in keeping the species distinct from both *Astræa* (*Favia*) *okeni*, Milne-Edwards and Haime, and *Astræa* (*Favia*) *tubulifera*, Klunzinger.

Locality.—Banda.

8. *Astræa ananas* (Ellis and Solander).

Madrepora ananas, Ellis and Solander, Zoophytes, p. 168, pl. xlvii. fig. 6.
Favia ananas, Milne-Edwards and Haime, Cor., ii. p. 435.

A single small specimen was obtained, incrusting a piece of rock. In the young stages the species appears to be very close to the broad-walled form of *Astræa fragum*, and also closely resembles the *Astræa porcata*, Esper,[1] which is found in the East Indies.

Locality.—Bermuda.

9. *Astræa coarctata* (Duchassaing and Michelotti).

Favia coarctata, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 76, pl. x. figs. 17, 18.

The specimen which I have referred to this species consists of a small colony of five calicles, which was found growing on the base of a large *Mæandrina*. Two of these calicles are subcircular, while the other three are much elongated, and two of them show

[1] Pflanz. Forts., Madrep., pl. lxxi.

clearly the process of division. The short description applies closely to the specimen, and the figure of the entire corallum (fig. 17) well represents it, but the calicles, as seen in fig. 18, differ from it, and also from the description, in the absence of the well-marked teeth.

The corallum is incrusting, slightly convex, and with a well-developed epitheca; the calicles rather close, subcircular or elongated, rather deep, from 3 to 5 mm. long, 1 to 3 mm. wide, and about 2 mm. deep, borders free, with prominent toothed costæ connecting adjacent calicles. Septa in three complete cycles, a fourth rudimentary, thin, exsert, finely toothed and very granulated, the innermost parts confluent with each other and with the slightly developed columella.

Locality.—Bermuda.

10. *Astræa fragum* (Esper).

Madrepora fragum, Esper, Pflanz., i. Forts., p. 79; Madrep., pl. lxiv.
Favia fragum, Milne-Edwards and Haime, Cor., ii. p. 439.

The specimens of this species are very abundant on the shore; and are in every respect identical with the ordinary West Indian forms. The calicles attain very often a diameter of 8 mm., and are much more closely placed in the middle than at the margin of the colony where the walls are much thicker and the costæ conspicuous. In many of the largest calicles rudiments of a fifth cycle are often present.

Locality.—St. Vincent, Cape Verde Islands.

Genus 19. *Goniastræa*, Milne-Edwards and Haime.

Goniastræa, Milne-Edwards and Haime, Cor., ii. p. 444.
„ Duncan, Rev. Madrep., p. 102.

An extremely interesting modification of the pali is found in one of the species of this genus, *Goniastræa multilobata*, n. sp., in which these structures are often much divided and irregularly placed.

Eight species of the genus were obtained.

1. *Goniastræa multilobata*, n. sp. (Pl. III. fig. 2–2*c*).

Corallum incrusting at base, rising into short, thick, and broad, obtuse branches or lobes which become more or less coalescent laterally. Calicles very unequal and irregular, polygonal, oblong or much elongated, straight or sinuous. In the greater number of the calicles, especially on the apical parts of the branches, division is so rapid that many of them contain two, three or more centres incompletely separated from each other; and

where these are in the same line, the parent calicle becomes very long. The simple cells are from 5 to 10 mm. in diameter, and from 2 to 5 mm. deep. The walls are often 2 mm. thick and rounded, but generally they are thinner and somewhat acute. The septa are somewhat truncated above, exsert, narrow, thin, and irregularly denticulate, and give a ragged aspect to thecorallum; they are of three or four cycles, the last two being small and incomplete. The pali are very uneven and irregular, thin, elongated and generally much divided and denticulate. The columella of a few small shorter points often scarcely distinct from the pali. Endotheca abundant, dissepiments very small, thin and irregular.

This species recalls many of the characters of *Goniastræa planulata* and *Goniastræa coronalis*, andrepresents an extreme form of the genus.

Two large specimens were obtained.

Locality.—Amboina.

2. *Goniastræa eximia* (Dana).

Astræa eximia, Dana, Zoophytes, p. 242, pl. xiii. fig. 4.

A small but excellent specimen of this well-marked species was obtained. The walls are extremely compact, and the corallum in consequence very heavy. Those cells which are in process of division are often quite large, being about 6 mm. in diameter.

Locality.—Banda.

3. *Goniostræa cerium* (Dana).

Astræa cerium, Dana, Zoophytes, p. 245, pl. xiii. fig. 8.

This species has much of the appearance of *Goniastræa eximia*, but its calicles are much smaller and quite shallow. The diameter of the calicles is from about 3 to 4 mm., and the depth about 1 mm. The walls are solid and thick, marked with slightly exsert septa. The pali are small but distinct, and are placed on the larger septa. The third cycle is incomplete and small, and rudiments of a fourth cycle are present in the larger cups.

Locality.—Kandavu, Fiji.

4. *Goniastræa favistella* (Dana).

Astræa favistella, Dana, Zoophytes, p. 241, pl. xiii. fig. 2.

Only a fragment of the basal part of a specimen of this species occurs in the collection. The septa are of four cycles, the last being incomplete and very small; occasionally rudiments of a fifth cycle are to be found.

Locality.—Banda.

5. *Goniastræa quoyi*, Milne-Edwards and Haime.

Goniastræa quoyi, Milne-Edwards and Haime, Cor., ii. p. 447.

Two fine specimens were collected. The species is very variable in many of its characters, and this can be easily seen on different parts of the same specimen. The calicles may be deep or quite shallow and open; the walls may be rather thick or quite thin; the septa slightly exsert or included, appearing as narrow, oblique or erect lamellæ; the pali may be small and scarcely distinct or thick and well developed, and the columella may be trabeculate or finely spongy. Septa of the fourth and fifth cycles are often developed, but the latter are small and scarcely distinct.

Localities.—Banda; Somerset, Cape York, shore.

6. *Goniastræa grayi*, Milne-Edwards and Haime.

Goniastræa grayi, Milne-Edwards and Haime, Cor., ii. p. 447.

This species is very close to *Goniastræa quoyi*, but appears to be distinguished by the regularly deep calicles, by the closely crowded and extremely narrow, erect, numerous septa, by the thicker and stronger pali, and the more abundant spongy columella. The walls have a very even outline owing to the closely placed narrow septa. A small specimen was obtained.

Locality.—Mactan Island, Philippines.

7. *Goniastræa coronalis*, n. sp. (Pl. III. figs. 3–3*a*).

Corallum rather thin, explanate or slightly convex above, with the edges quite thin and trenchant; the under surface covered with a strong epitheca and radially ridged up to the margin, showing the course of the calicles. Calicles unequal and irregular, generally pentagonal, often elongated and in process of division, the larger diameter being from 10 to 18 mm., many small calicles interspersed between the larger ones, the depth of the calicles from 3 to 5 mm. Many cups quite shallow. Three, four or five cycles developed, the last cycle in each calicle being incomplete and very small; septa narrow, rather thin, a little exsert, projecting but little from the wall, which is strong, moderately thick, and not rounded above; the edge of the septa very closely and finely denticulate with sharp, short and simple teeth. Pali very large, distinct, and broad, often twice as broad as the septa, elevated, leaving a central depression between them which is occupied by a scant trabeculate columella, the upper border of the pali strongly denticulate.

This species resembles *Goniastræa planulata* in many of its characters, but is easily

distinguishable by the nature of the wall, the septa, and the pali. The characters of the pali will readily separate it from all other species.

A very fine but rather small specimen was collected.

Locality.—Banda.

8. *Goniastræa laxa*, n. sp. (Pl. III. figs. 4–4*d*).

Corallum incrusting, forming broad, convex spreading masses. Calicles oblong or polygonal, from 6 to 8 mm. in the long diameter, and from 3 to 5 mm. deep; walls generally quite thin and acute, rarely flattened and wide; septa very unequal, wide apart, of three cycles, those of the third cycle very small and often quite rudimentary, very seldom there are rudiments of a fourth cycle in some of the largest calicles; from about seven to nine large septa reach to the centre, surmounted by small, long, upright pali, which are scarcely distinguishable from paliform teeth, and surround a central depression in which there is no trace of a columella. The septa are exsert, slightly thickened at the wall, and finely and raggedly denticulate, giving a rough appearance to the corallum. Endotheca very abundant, visible above between the larger septa; the dissepiments small, very thin and close.

This species presents an interesting modification of the structure of the wall, the thick and flat form showing a very decided approach to the genus *Astræa*.

The species has also a very great resemblance to forms of the genus *Prionastræa*, and this is greatly increased by the slight development of the pali, which sometimes do not seem to differ in any respect from large paliform teeth. The increase by fission seems, however, to be evident in many parts of the corallum, though it is, confessedly, difficult in the dried condition to distinguish this from sub-central, intra-calicinal gemmation. It is possible, on this account, that this form will have to be referred to the genus *Prionastræa* when living specimens of the species have been examined.

Two specimens, one a fine and large one, were collected.

Locality.—Api, New Hebrides. One of the four most abundant reef-forming species in this locality.

Genus 20. *Acanthastræa*, Milne-Edwards and Haime.

Acanthastræa, Milne-Edwards and Haime, Cor., ii. p. 501.
„ Duncan, Rev. Madrep., p. 119.

Acanthastræa irregularis, n. sp. (Pl. IV. figs. 2–2*a*).

Corallum spreading, forming a thickened, convex plate. Epitheca well developed to the very edge, slightly wavy. Calicles unequal, subcircular, oblong or polygonal,

varying in size from about 14 to 20 mm. in diameter and from 5 to 8 mm. in depth; walls simple, often quite thin, generally thickened, slightly rounded, and about 2 mm., rarely 3 mm., wide. Septa unequal; very thin within the cup, with numerous, rather long, fine teeth; much thickened, and projecting but slightly at the edges, being from about 1 to 1·5 mm. thick, with slightly swollen fistular teeth, which are often nearly 2 mm. long; of five cycles in the large calicles, the last being quite incomplete and very small, distinct only on the sides; in the smaller calicles the fourth cycle is incomplete and small. As the small septa are not continued to the centre, wide and open interseptal spaces are seen, in the centre of which is a scant, papillose columella.

The species seems to take an almost intermediate position between the *Acanthastræa hirsuta*, Milne-Edwards and Haime, and the *Acanthastræa angulosa*, Brüggemann. From the former it is distinguished by the larger and shallower cells, by its thinner, nearly rounded, simple wall, and by the thinner, more numerous, and very unequal septa: from the latter, by its larger and deeper cells, by its thicker, more rounded wall, and by its more thickened, fistular, more equally prominent septa, which, being less crowded towards the centre, leave the endotheca clearly visible at the bottom of the wide, interseptal spaces. In the *Acanthastræa angulosa*, the larger septa are very irregularly and raggedly prominent above the thin wall, and give a striking appearance to the corallum.

A single rather small specimen only was collected.

Locality.—Kandavu, Fiji.

Genus 21. *Prionastræa*, Milne-Edwards and Haime.

Prionastræa et Metastræa, Milne-Edwards and Haime, Cor., ii. pp. 513, 525.
Prionastræa, Duncan, Rev. Madrep., p. 123.

This genus has been extended by Professor Duncan to include the *Metastræa* of Milne-Edwards and Haime.

Four species were obtained.

1. *Prionastræa flexuosa* (Dana).

Astræa flexuosa, Dana, Zoophytes, p. 227, pl. xi. fig. 6.

The cells are very irregular, often much elongated, curved and narrow, but deep; the ridges are scarcely or not at all sulcate: the septa of five cycles, the last imperfectly developed. The walls are often quite thin.

Locality.—Kandavu, Fiji.

2. *Prionastræa robusta* (Dana).

Astræa robusta, Dana, Zoophytes, p. 248, pl. xiii. fig. 10.

The cells on the apical parts of the lobes are deep, with very thin walls and narrow septa; on the basal parts the cells become shallow, with broader septa and thicker walls.

The species is very close to the *Prionastræa abdita* and probably will have to be united with it.

Locality.—Amboina.

3. *Prionastræa obtusata*, Milne-Edwards and Haime.

Prionastræa obtusata, Milne-Edwards and Haime, Cor., ii. p. 518.

The extremely narrow and thin septa, which appear as mere denticulate striations on the thick and compact walls, give a peculiarly open and naked appearance to the calicles. A fifth cycle is generally represented, but remains very imperfect and small.

Locality.—Kandavu, Fiji.

4. *Prionastræa quoyi*, Milne-Edwards and Haime.

Prionastræa quoyi, Milne-Edwards and Haime, Cor., ii. p. 519.

The walls in this species are very unequal. In many of the outer cups the walls are often from 3 to 4 mm. wide, and distinctly sulcate, and the septa are firm and rather thick; but generally the walls are thin, from 1 to 2 mm. wide, scarcely or not at all sulcate, and the septa are very thin, with subtrabeculate teeth. The fourth cycle is imperfectly developed.

Two specimens were collected.

Locality.—Reefs, Fiji.

Genus 22. *Plesiastræa*, Milne-Edwards and Haime.

Plesiastræa, Milne-Edwards and Haime, Cor., ii. p. 489.
„ Duncan, Rev. Madrep., p. 107.

This genus is extremely close to *Orbicella*, from which it is distinguished by the presence of pali. In those species of *Orbicella*, in which a strong paliform lobe is developed, it is a matter of great difficulty to distinguish these structures from the pali of *Plesiastræa*.

Two species are in the collection.

1. *Plesiastræa urvillei*, Milne-Edwards and Haime.

Plesiastræa urvillei, Milne-Edwards and Haime, Cor., ii. p. 490.

Of this species a small flattened specimen occurs, which differs from the ordinary form in having the calicles placed more widely apart, and the septa more prominent. The pali are generally unequal.

Locality.—Kandavu, Fiji.

2. *Plesiastræa indurata*, Verrill.

Plesiastræa indurata, Verrill, Proc. Essex Inst., vol. v., part 3, p. 35, pl. ii. fig. 7.

A single fine specimen is referable to this species. It is close to *Plesiastræa coronata*, but differs in its larger and deeper cells and its more numerous septa. Towards the outer part of the corallum the cells are very obliquely placed, as in *Plesiastræa coronata*.

Locality.—Kandavu, Fiji.

Genus 23. *Phymastræa*, Milne-Edwards and Haime.

Phymastræa, Milne-Edwards and Haime, Cor., ii. p. 499.
„ Duncan, Rev. Madrep., p. 106.

Phymastræa aspera, n. sp. (Pl. IV. figs. 1–1*b*).

Corallum massive, heavy, irregularly convex. Calicles rather large, very unequal and deep, polygonal, circular, oval or elongated, greatest width from about 9 to 11 mm., many calicles less, about 4 to 5 mm. deep; furrows between the calicles well marked, very narrow, with deep spaces between the connecting portions occupied by small tubes —apparently worm tubes—which preserve the intercalicinal spaces and keep them open during the growth of the colony; costæ unequal, denticulate, those of opposite cups often coalescing. Septa not perforated, of five cycles, the last being very rudimentary, the fourth being small; those of the three first cycles are subequal, large, and rather thick, much exsert, and roughly, unequally, and bluntly toothed; the innermost teeth are very distinct, large, long, and paliform, not divided, surrounding a distinct deep and narrow depression, at the bottom of which is a small, subtrabeculate or papillose columella which is almost absent in a transverse section. Texture of the corallum very dense and hard.

This species is represented by a single specimen. At the outer part, the cups become rather shallow and approach very closely to the form of those of *Phymastræa valenciennesi*. It is, however, distinguished from *Phymastræa valenciennesi* by its convex mode of growth, by its more distinct and prominent calicles which are also quite deep, by the much greater development of the septa, which are more exsert, numerous, and closely placed, not perforated, with non-bifurcated and large paliform teeth, and by the slight development of columella. From *Phymastræa profundior* it is distinguished by the large size and irregular growth of the calicles, and by the numerous septal orders, the septa being quite close, exsert and thickened, furnished with a very distinct, large, paliform lobe.

Locality.—Banda.

Genus 24. *Orbicella*, Dana.

Orbicella, Dana, Zoophytes, p. 206.
Heliastræa, Milne-Edwards and Haime, Cor., ii. p. 456.
„ Duncan, Rev. Madrep., p. 104.

Verrill[1] has pointed out that this name should be applied to this group rather than the later term *Heliastræa* of Milne-Edwards and Haime, which has been adopted by the generality of recent writers.

Orbicella cavernosa (Esper).

Madrepora cavernosa, Esper, Pflanz. Forts., p. 18, Madrep. pl. xxxvii.
Orbicella argus, Dana, Zoophytes, p. 207.
Heliastræa cavernosa, Milne-Edwards and Haime, Cor., ii. p. 463.

From the accurate descriptions given by Dana and by Milne-Edwards and Haime of this common West Indian form, the specimens obtained off Barra Grande, Brazil, differ but slightly in having the surface of the intercalicinal spaces vesiculate, causing the union of the costæ of adjoining calicles with one another to be indistinct, and also in having the septa more uniformly thickened throughout. It was obtained from a depth of 30 fathoms, and tends to prove that species of Coral, which are reef-building forms, live at much greater depths than is usually believed. The rounded masses, as stated by Professor Moseley in his journal, were about 2 feet in diameter at the flat base, and were extremely and regularly convex above. When broken open, these masses were found to be bored by *Lithodomus dactylus*, but the molluscs were dead, apparently shut in by the rapid growth of the Coral.

Locality.—Barra Grande, Brazil, 30 fathoms.

Genus 25. *Cyphastræa*, Milne-Edwards and Haime.

Cyphastræa et *Solenastræa*, Milne-Edwards and Haime, Cor., ii. pp. 484, 495.

Following Klunzinger,[2] I have united the genera *Solenastræa* and *Cyphastræa* under the latter name, which was first defined by Milne-Edwards and Haime, and should therefore be retained. The extreme forms of the genus present very striking differences, and would certainly warrant generic separation but for the clearly intermediate nature of many other species.

Four species were obtained.

1. *Cyphastræa pleiades* (Ellis and Solander).

Madrepora pleiades, Ellis and Solander, Zoophytes, p. 169, pl. liii. figs. 7, 8.
Astræa pleiades, Dana, Zoophytes, p. 213, pl. x. fig. 5.

A dead and worn specimen occurs in the collection. The size of the cells is rather variable, being often only 2 mm., especially towards the basal part of the colony. The

[1] Dana, Coral and Coral Islands, p. 336.
[2] Cor. roth. Meer., iii. p. 50.

habit of growth is incrusting, and it spreads over and ultimately surrounds the object on which it grows.

Locality.—Mactan Island, Philippines.

2. *Cyphastræa microphthalma* (Lamarck).

Astræa microphthalma, Lamarck, Hist. Anim. sans Vert., ii. p. 273, 1816.
Cyphastræa microphthalma, Milne-Edwards and Haime, Cor., ii. p. 485.

A small gibbous specimen, the growth of which has been much disturbed by parasites, presents some interesting varietal points. The columella is scarcely seen from without, and is but slightly developed; the cups are generally quite close, especially in the depressed parts, evenly rimmed with prominent and wide septa, which are much thinner at the wall than is shown by Milne-Edwards and Haime.[1]

Locality.—Mactan Island, Philippines.

3. *Cyphastræa aspera*, n. sp. (Pl. IV. figs. 3–3*a*).

Corallum incrusting, forming a thin layer. Epitheca very distinct at the margin. Calicles circular, nearly immersed, about 1·5 mm. wide, very deep, separated by interspaces equal to their own diameter; costæ scarcely distinct, finely and obsoletely spinulose; wall nearly even with the surface. Septa extremely exsert, easily broken away, slightly thickened and very narrow, scarcely projecting into the fossa, forming a circle of high, rather delicate, narrow, cultriform plates at the margin of the calicles which give to the corallum a rough bristling aspect; of three cycles, the last incomplete and very small; those of the first and second cycles indistinguishable in size from each other, but very unequal on opposite sides of the same calicle, granulated and subentire. Columella small or rudimentary.

A small specimen of this interesting species was obtained, consisting of a thin, living, rather uneven layer, which has spread over an equally thin, dead layer. It differs considerably in appearance from the ordinary species of *Cyphastræa*, but seems to be connected with them by the *Cyphastræa ocellina* (Dana). Its general appearance recalls the *Oculinæ*, as mentioned by Dana for the *Cyphastræa ocellina* and *Cyphastræa danæ* (=*Astræa microphthalma*, Dana).

Locality.—Api, New Hebrides.

4. *Cyphastræa brueggemanni*, n. sp. (Pl. IV. figs. 4–4*a*).

Corallum incrusting at base and surrounding other bodies, forming in this manner large, rounded, unevenly globose masses, which are attached by a very small base.

[1] *Ann. d. Sci. Nat.*, ser. 3, vol. x. pl. ix. fig. 5.

Calicles closely placed, separated by spaces equal to about half of their diameter or less except at the outer part of the colony where they are more distant; circular, deep, slightly prominent, rather large, being from about 2·5 to 3 mm. wide; costæ distinct only in the neighbourhood of the calicles, the outer border almost vertical, thickened and denticulate; the intercalicinal spaces finely and irregularly echinulate; walls thin; septa of three complete cycles, slightly thickened at the wall; the first and second cycles equal, exsert and subtruncated, finely denticulate, very granulated, broad, leaving a very narrow central space, at the bottom of which is the well-developed and trabeculate columella, chiefly formed by the perforated edges of the septa; septa of the third cycle, generally narrow and thin, and distinct only at the wall. Exotheca subvesicular, rather dense and compact.

This species is named after the late Dr. Brüggemann, who first recognised its specific distinctness, but did not describe it. Owing to the equal prominence of the primary and secondary septa, the calicles have a very even and regular appearance.

One specimen in the collection presents an interesting variety of growth, which seems to have been produced by injury due to exposure. Apparently the polyps over nearly the whole surface must have been killed, except on a small area, from which subsequent growth has proceeded, covering a considerable lateral portion of the old corallum with a thin layer, the edges of which are clearly distinguishable from the older growth.

Locality.—Mactan Island, Philippines.

Genus 26. *Leptastræa*, Milne-Edwards and Haime.

Leptastræa et *Baryastræa*, Milne-Edwards and Haime, Cor., ii. pp. 493, 512.

Following Klunzinger,[1] I have united the *Leptastræa* and *Baryastræa* of Milne-Edwards and Haime under the former name. These genera do not seem to be separated from each other by any character of classificatory value.

Four species are in the collection, obtained at Tahiti. Three of them do not seem to differ in any marked character from the Red Sea forms.

1. *Leptastræa solida* (Milne-Edwards and Haime).

Baryastræa solida, Milne-Edwards and Haime, Cor., ii. p. 512, pl. D. 8, fig. 2.

The larger calicles in this species often attain a diameter of 5 mm., with the fourth cycle imperfectly developed.

A small specimen occurs in the collection.

Locality.—Tahiti.

[1] Cor. roth. Meer., iii. p. 43.

2. *Leptastræa ehrenbergana*, Milne-Edwards and Haime.

Leptastræa ehrenbergana, Milne-Edwards and Haime, Cor., ii. p. 494, pl. D. 7, fig. 4.

A specimen in the collection differs from the Red Sea form in having the cups deeper, being generally as much as 3 mm. The small septa are sometimes united with one another at the centre, as in *Leptastræa stellulata*.

This species, which has been redescribed and figured by Klunzinger,[1] seems to be scarcely distinct from *Leptastræa purpurea* (Dana).

Locality.—Tahiti.

3. *Leptastræa roissyana*, Milne-Edwards and Haime.

Leptastræa roissyana, Milne-Edwards and Haime, Ann. d. Sci. Nat., ser. 3, vol. x. pl. ix. fig. 6; Cor., ii. p. 494.

The form of the corallum is very variable owing to the shape of the body which it incrusts; generally, however, it becomes thick, massive, and convex at the central portion.

Two small, unevenly convex specimens are in the collection.

Locality.—Tahiti.

4. *Leptastræa transversa*, Klunzinger.

Leptastræa transversa, Klunzinger, Cor. roth. Meer., iii. p. 46, pl. vi. fig. 2.

A specimen in the collection differs from the ordinary plate-like form of the species in having an irregular nodular incrusting corallum, which assumes the shape of the body it has covered. The thin grooved walls and the very thin septa give a delicate appearance to the species. The cups are often nearly 3 mm. deep, and the columella but slightly developed.

Locality.—Tahiti.

Genus 27. *Merulina*, Ehrenberg.

Merulina, Ehrenberg, Cor. roth. Meer., p. 104.
„ Milne-Edwards and Haime, Cor., ii. p. 628.
„ Duncan, Rev. Madrep., p. 128.

Two species of the genus were obtained.

1. *Merulina crispa*, Dana.

Merulina crispa, Dana, Zoophytes, p. 274.

A small specimen of this small species was obtained. The septa are not evenly lax, but are generally closely placed, except at the extreme apical parts. The *Merulina*

[1] Cor. roth Meer., iii. p. 46, pl. vi. fig. 3.

ramosa, Milne-Edwards and Haime, seems to be very close to this species, and appears to correspond with the upright, narrow foliated form which results from the flexure of the frond, and the coalescence and upgrowth of the opposed surfaces.

Locality.—Banda.

2. *Merulina prolifera*, n. sp. (Pl. V. figs. 1–1*a*).

Corallum small, ramose, with the branches very slender, much divided, closely crowded, and very coalescent; forming dense, intricate clumps, covered above with dense clusters of small branchlets, which are angular, irregular, and often much flattened, alate, palmated and divaricate; the branches are from 3 to 5 mm. thick, widening at the point of origin of the branchlets. The ridges are very small, narrow and elongated on the branches, and almost obsolete; more distinct on the branchlets where they are much raised and very acute. The calicinal centres are very indistinct; the septa are narrow, closely placed and short on the branches, less crowded, long and broad on the branchlets, especially on the extreme apical parts, where they are very prominent.

This species is close to the *Merulina laxa*, Dana, but differs in many characters. The specimen forms a clump about 11 cm. in height and about the same in diameter.

Locality.—Ternate.

Family Cyathophyllidæ.

Genus *Moseleya*, Quelch.

Moseleya, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 292.

Corallum compound, flattened, or slightly and broadly convex. Young calicles developing by calicinal marginal budding around a very large median calicle, which has very numerous septal orders, the calicles becoming polygonal and deep at the centre. Epitheca very slight, wall very thin and almost rudimentary, but developed so as to give a distinct, simple line of separation to the calicles on the surface, often interrupted, seen in section in a very rudimentary state separating the calicinal centres. Costæ very distinct, thin, and finely denticulate. Septa often confluent and continuous from centre to centre in the line of union between adjoining calicles, very thin and close, finely toothed above, and having the teeth subequal or slightly larger near the centre. Endothecal dissepiments vesicular, very abundantly developed, leaving but a very small portion of the septa free exteriorly, except at the centre of the cup, which is thus much depressed; they are often arranged in concentric circles, which are very distinct at the central portion, where by fusion and consequent thickening they form well-marked sub-infundibuliform tabulæ. A false columella is present, seen exteriorly to be formed

by the trabeculate and vermiform structure of the innermost upper part of the septa, absent in transverse section. In the tabulæ the septa are rather distinct, and are seen to meet quite at a point at the centre.

It is thus seen that this genus agrees with *Cyathophyllum* in every essential respect except that the septa are not alternately equal. In *Moseleya* the septa are of variable length, terminating either at the centre or close to the outer border, or at almost any intermediate point, though not infrequently they are alternately subequal, a condition more clearly seen in transverse section. A decided approach, however, is found in many species of *Cyathophyllum*, where in transverse section three or even four different lengths of septa are frequently present (*e.g.*, *Cyathophyllum stutchburyi*, *Cyathophyllum rugosum*, *Cyathophyllum regium*).

With *Strombodes*, the agreement in the lengths of the different orders of septa is very close, but the wall is much more developed in *Moseleya*, while the septo-costæ do not form the vesicular, trellised appearance so common in *Strombodes*.

Moseleya latistellata, Quelch (Plate XII. figs. 1–7).

Moseleya latistellata, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 293.

Calicles very large, the parent median calicle attaining a width of about 6 cm., but becoming smaller by the development of new calicles around it, and attached by a very broad base to the surface on which it grew. Epitheca and wall very thin, the wall often rudimentary between the confluent septa of adjacent calicles. Costæ distinct and finely denticulate above, continuing as well-marked lines to the very base. Septal system containing orders of seven cycles, but the last two cycles are incompletely developed, there being about two hundred septa in the largest calicle; the septa are thin, finely cut into subequal sharp teeth (nearly 1 mm. in length), laterally granulated and thickened, chiefly so in the direction of the teeth, free above only for a short portion owing to the great development of vesicular endotheca, but at the centre exteriorly the endotheca is much less developed, and consequently the calicles become much deeper and the septa more prominent. The septa of the first two or three orders are about equal, and run nearly or quite to the centre; those of the higher orders are somewhat smaller and shorter, though many run nearly to the centre; the highest orders are very small and are distinct only at the edge of the calicles. With the exception of these last, the septa are regularly placed and equally raised, giving a very even appearance to the calicles, especially to the older ones. Pali and true columella absent; but the finely trabeculate inner and upper edges of the septa give the appearance of a small columella. Endotheca abundant, vesiculate; vesicles large.

Of this species a single specimen was obtained. It consists of a very large central parent calicle, around which have developed by marginal budding several smaller calicles,

which in their turn have also given rise to smaller ones. The parent calicle is circular, and attains a very large size, apparently being more than 6 cm. in diameter, before the development of buds takes place around it; and by the encroaching of the smaller calicles upon its surface, it becomes at the same time both polygonal in shape and smaller in size. A very curious feature is that the parent calicle of the colony has grown out of, and immediately above, another large similar calicle which was simple and which produced no marginal buds to form a colony. It seems to be a simple case of rejuvenescence, although the border of the lower calicle projects for some little distance on one side beyond and outside of the base of the upper one. It is easily understood that, if the same conditions had prevailed during the growth of the second upper calicle, and throughout successive generations, as had prevailed during the life of the dead lower one, instead of forming a convex colonial mass, the whole colony would have assumed the appearance of an elongated cylinder made up of successive superposed calicles, as in the simple species of *Cyathophyllum*.

A veryyoung stage of the species is seen on the projecting portion of the dead lower calicle, where a small calicle has budded off. In this small cup three large and thick septa are distinctly seen, arranged like three arms of a Maltese cross, while the fourth arm is but slightly, though distinctly, larger than the septa around it. Though thus pointing to a distinct tetrameral arrangement of the septa, it seems to me, however, to be more likely a case of accidental growth, since no clear evidence of tetrameral arrangement can be found in the other calicles of the colony.

The tabulæ of this form are peculiar, and present rather closely the shape found in *Strombodes*. Looked at from below, they are seen to be sub-infundibuliform, the septa being prolonged to meet at the centre. At this point, and for some distance around it, the obliquely placed dissepiments coalesce to form a nearly solid, dense plate in which the septa can be distinguished.

Though differing from the most completely formed tabulæ, as seen in *Amplexus*, by this distinctness of the septa, the tabulæ of *Moseleya latistellata* present all the fundamental features of those characteristic of many of the Cyathophyllidæ, in several of which also the septa are distinguishable. The tabulæ are placed regularly one above the other, with vesicular endotheca between them, as can easily be shown by removing the basal pointed part of the lower one, when the interior one is laid bare. They apparently correspond with the basal part of the new calicles, which are formed, probably, by rejuvenescence above the previously existing one; and in transverse section are seen as concentric circles of more or less variable thickness and regularity.

A transverse section, across the parent calicle, has been made of the single specimen obtained; but, owing to the small size and the thinness of the remaining parts, a vertical section would have been of no practical use, and was not attempted. The shape and nature of the tabulæ and their relation to each other, however, can be easily demonstrated by the views of the basal part of the corallum, where

the dissepiments have been removed to lay bare the tabulæ, and where one tabula has been partly removed to show the one above it.

Locality.—Wednesday Island, Torres Straits, 8 fathoms.

Section MADREPORARIA FUNGIDA.

Family Plesiofungidæ.

Genus 1. *Siderastræa*, Blainville.

Siderastrea (pars), Blainville, Dict. d. Sci. Nat., lx. p. 335.
Astræa, Milne-Edwards and Haime, Cor., ii. p. 505.
Siderastræa, Duncan, Rev. Madrep., p. 134.

Siderastræa galaxea (Ellis and Solander).

Madrepora galaxea, Ellis and Solander, Zoophytes, p. 168, pl. xlvii. fig. 7.
Astræa radians, Milne-Edwards and Haime, Cor., ii. p. 506.

Following Pourtalès[1] I have adopted the specific name of Ellis and Solander instead of that of Pallas. Only a single specimen was obtained, and it forms an almost spherical, free mass, about 8 cm. in diameter. The species is very variable in the thickness and prominence of the primary and secondary septa. Excellent figures are given in the plates of the Report on the Florida Reefs.[2]

Locality.—Bermuda.

Genus 2. *Tichoseris*, Quelch.

Tichoseris, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 295.

Corallum compound, massive, columnar or lobate, with neither transverse calicinal ridges nor longitudinal crests, astræiform. Calicles with distinct, elevated walls, which are solid throughout, thin at their upper edges, but thick at the basal part of the calicles; calicinal centres arranged sometimes singly within their own walls, but generally united in more or less irregularly sinuous groups of two or more centres, incompletely separated from one another, and surrounded by the common wall of the calicle from which they are developed. New calicles arise either by direct division of a single calicle forming two separate ones with distinctly raised walls, or by the upgrowth of synapticulæ at one or more parts of the calicle to form new walls, the resulting centres forming more or less mæandrine series, until the final development of their own wall isolates them. Septa solid, entire, not confluent, those of adjoining calicles quite separated by the elevated wall, but often directly opposite each other. Columella absent or forming deep down a small styliform projection at the point of coalescence of the

[1] *Illust. Cat. Mus. Comp. Zoöl.*, No. iv. p. 81. [2] *Mem. Mus. Comp. Zoöl.*, U.S.A., vol. vii. No. i.

inner margin of the septa. Synapticulæ distant, very unequally and irregularly developed, being generally rather thick, interseptal outgrowths of the upper part of the wall. Endotheca well developed, deep down, easily seen in a vertical section. A transverse section shows the calicles with distinct centres generally arranged in sinuous valleys, which are bounded by thick and solid walls.

This genus is close to *Pavonia*, in some species of which an approach is made at the apical parts of the corallum to the arrangement of the calicles in isolated and sub-sinuous groups with elevated and solid walls. In *Tichoseris*, however, the walls are elevated at all parts of the corallum, the interseptal chambers are extremely deep, the dissepiments being inconspicuous from above, and the sinuous and mæandrine arrangement of the calicles well marked.

Tichoseris obtusata, Quelch (Pl. V. figs. 3–3*c*).

Tichoseris obtusata, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 296.

Corallum consisting of blunt, elongated or rounded, lobate masses, of very dense structure throughout. Calicles small; often separate, subcircular or elongated and polygonal, from about 3 to 5 mm. in diameter, deep, but often appearing almost filled up and shallow, owing to the closely packed septa; more generally from two to six or more calicles are grouped together, with their walls incompletely developed, so that they give the appearance of many centres surrounded by one raised wall, which is of very irregular shape and size, being long, sinuous, mæandrine, and narrow, or rounded and wide, often from 5 to 14 mm. in diameter. Wall very solid throughout, thin-edged above, but thick below. Septa not exsert, very numerous, in the separate calicles there are as many as five cycles, but the fifth is very incomplete; those of the first two cycles are subequal those of the fourth and fifth very small; but all are entire, very thin, extremely granulated or finely echinulated on their sides, with their inner edges nearly vertical. Columella very rudimentary. Dissepiments very thin, and rather widely separated.

Two small specimens of this species were obtained.

Locality.—Reefs, Fiji.

Genus 3. *Pavonia*, Lamarck.

Pavona (pars), Lamarck, Syst. Anim. sans Vert., p. 382, 1801.
Pavonia (pars), Lamarck, Hist. Anim. sans Vert., ii. p. 238, 1816.
Lophoseris, Milne-Edwards and Haime, Cor., iii. p. 65.
„ Duncan, Rev. Madrep., p. 157.

As Verrill[1] points out, Lamarck's application of the name *Pavonia* claims priority over Hübner's use of the term for a genus of Lepidoptera, and it must therefore be retained. The dissepiments, which were not noticed by Milne-Edwards and Haime, have been described by Verrill, as already stated.

Five species were obtained.

[1] *Trans. Connect. Acad.*, vol. i. p. 543, 1868.

1. *Pavonia divaricata*, Lamarck.

Pavonia divaricata, Lamarck, Hist. Anim. sans Vert., ii. p. 240, 1816.
„ „ Dana, Zoophytes, p. 327, pl. xxii. fig. 6.

Three fragments of this species were obtained. *Pavonia seriata* and *Pavonia minor*, Brüggemann, are so close both to one another and to this species that it seems likely they will have to be united with it.

Locality.—Tongatabu.

2. *Pavonia crassa*, Dana.

Pavonia crassa, Dana, Zoophytes, p. 331, pl. xxiii. fig. 2.

Two small fragments of this species were obtained, which are about 1 cm. thick at a distance of 2·5 cm. from the margin. The septa are scarcely crowded and the surface consequently has a rather open appearance. The special septa, which are continuous from centre to centre in a transverse direction, are thickened and very conspicuous.

Locality.—Tongatabu.

3. *Pavonia decussata*, Dana.

Pavonia decussata, Dana, Zoophytes, p. 329, pl. xxii. fig. 4.

A single specimen referable to this species was obtained. The greater portion of it consists of a dead corallum, which has been overgrown and almost entirely covered by fresh growth, so that the specimen becomes very like a small one of *Pavonia crassa*. The larger lobes, which have been formed chiefly by this incrustation over previously formed plates, are on this account much thicker than those in the specimens described by Dana. Numerous small plates spring out irregularly over the surface.

It is very close to *Pavonia* (*Madrepora*) *cristata*, Ellis and Solander.

Locality.—Api, New Hebrides.

4. *Pavonia formosa*, Dana.

Pavonia formosa, Dana, Zoophytes, p. 525, pl. xxiv. fig. 2.

Two specimens of this species were obtained. One is a large, broad, and variously lobed frond, which originally was part of a very finely grown specimen, typical of the species; the other consists in great part of a dead corallum, the summits of which have been covered by fresh growth, which takes the form of very divided, rather thin lobes and crispate fronds. The species is very close to *Pavonia prætorta*, and the latter specimen seems to point to their identity.

Locality.—Tahiti.

5. *Pavonia prætorta*, Dana.

Pavonia prætorta, Dana, Zoophytes, p. 325, pl. xxii. fig. 5.

Some fine specimens and small fragments of this species were obtained. It is much more delicate than *Pavonia cactus*. The septa of the apical calicles are very unequal both in this species and in *Pavonia formosa*, which greatly resembles it; in the more basal calicles the septa are subequal.

Locality.—Tahiti.

Genus 4. *Agaricia*, Lamarck.

Agaricia (pars), Lamarck, Syst. Anim. sans Vert., p. 375, 1801.
Undaria et Mycedium (pars), Oken, Lehrb. der Naturg., Zool., i., 1815.
Agaricia et Mycedium (pars), Milne-Edwards and Haime, Cor., iii. pp. 72, 80.
Agaricia et Mycedium, Duncan, Rev. Madrep., pp. 158, 161.

The characters on which the genus *Mycedium* has been maintained to be separate from *Agaricia* seem to me altogether insufficient for generic distinction, and, bearing in mind the great variation which takes place in the concentrically seriate arrangement and circumscription of the calicles in the species which have been placed under these genera, I believe it will be impossible to find any fairly constant character by which to separate them. A careful comparison of a series of specimens of *Agaricia agaricites*, *Agaricia frondosa*, *Agaricia undata*, *Agaricia lamarcki*, *Agaricia* (*Mycedium*) *fragilis*, *Agaricia* (*Mycedium*) *elephantotus*,[1] will show all stages between the concentrically seriate arrangement of the scarcely circumscribed calicles and the more or less scattered arrangement with well circumscribed cups. This variability in the arrangement of the calicles is well shown even by individual specimens of the same species, *Agaricia* (*Mycedium*) *fragilis* furnishing a typical case, as pointed out by Pourtalès.[2] So completely transitional is this species between the more extreme forms of the genus, that Dana himself, while he places it in the subgenus *Mycedia*, states,[3] in his description of the species, that it "has much of the habit of *Agaricia undata*, and might with equal propriety be placed among the *Undariæ*" (*Agaricia* proper).

The *Mycedium* of Milne-Edwards and Haime, besides *Agaricia elephantotus*, contained three other species, two of which are forms of the genus *Phyllastræa*, *Phyllastræa tubifex*, and *Phyllastræa okeni*; and the other apparently an old form of a species of *Leptoseris*, *Leptoseris elegans*. The genus *Phyllastræa* is well distinguished, both by its spongy columella and by its distinctly scattered calicles, the well-developed, raised wall of which is very prominent on one side and is not due to flexure of the lamina nor to the fusion of synapticular structures. The genus *Leptoseris* was founded on a young

[1] This specific term, which was used by Pallas (Elench. Zooph., p. 168), and which has been retained in the same form by later writers, would seem to have been a misprint for "elephantopus."

[2] *Illus. Cat. Mus. Comp. Zoöl.*, Cambridge, U.S.A., No. iv.

[3] Zoophytes, U.S. Expl. Exped., p. 341.

specimen in which very few radial calicles had as yet developed around the central cup.[1] From young forms of the genus *Agaricia*, notably from those of the species *Agaricia fragilis*, Dana, it seems to me impossible satisfactorily to distinguish the genus *Leptoseris*, and most likely the two genera will have to be united.

Owing to the presence of dissepiments in this genus, it must be placed under the Plesiofungidæ, although the extremely close relationship between it and the Cycloseridæ seems to render such a classification extremely artificial. More research is needed on the presence of dissepiments in allied genera, and on the value which is to be placed on these structures for the classification of the Fungida.

Three species were obtained.

1. *Agaricia fragilis*, Dana.

Agaricia (*Mycedia*) *fragilis*, Dana, Zoophytes, p. 341.

A large and interesting series of specimens was obtained. They are of all sizes, from the very young stages up to those with a diameter of 25 cm., and show very clearly the great variability in the characters of the species. This variability was pointed out by Pourtalès in his Report on the Deep-Sea Corals,[2] where he remarks :—" Several of the specimens obtained by me in the same dredgeful, if seen separately from different localities, would unhesitatingly be pronounced different species." As stated by him, the species is distinct from *Agaricia undata*, but, as remarked by Milne-Edwards and Haime, it is very closely allied to it. Excellent figures are given in the plates of the Report on the Florida Reefs, in which all the developmental stages are figured. Pourtalès obtained it in the deep-sea dredgings, and remarks that it is not uncommon at less depths, although not common on reefs; but Professor Moseley remarks on its occurrence in very shallow-water on the Bermuda reefs, and states that it "occurs growing in colonies, in great abundance, in water from a foot to a fathom in depth, inside small caverns."[3]

Two specimens, obtained from St. Thomas, differ somewhat from the greater number of Bermuda ones in being thicker at the central parts, in having the calicles less closely placed, and in being more contorted and incrusting. They would seem to fall into the *Mycedium danæ*, Duchassaing and Michelotti, but this can only be regarded as a thick variety of the *Agaricia fragilis*, since the thickness, in different specimens, is very variable.

Localities.—Bermuda; St. Thomas.

[1] Voy. au pôle sud de Dumont D'Urville, Zool., vol. v. pl. xxix. fig. 1.

[2] *Illust. Cat. Mus. Comp. Zoöl.*, No. iv. p. 48.

[3] Notes by a Naturalist on the Challenger, p. 27.

2. *Agaricia frondosa*, Duchassaing.

Agaricia frondosa, Duchassaing, Revue des Zooph. et Spong. des Antilles.
„ „ Duchassaing and Michelotti, Suppl. Mém. Cor. des Antilles, pl. x. figs. 5, 6.

A single specimen of this species was obtained. It agrees very closely with the figures given by the authors, except that the magnified calicles are drawn with too many septa, there being seldom more than thirty. It bears a close resemblance to the young specimens of *Agaricia agaricites*, but instead of the evenly arranged, seriate calicles characteristic of that species, the calicles are closely placed but irregularly arranged, raised or depressed, and the synapticulate walls do not form thick, solid, sharp-edged crests.

Locality.—St. Thomas.

3. *Agaricia regularis*, n. sp. (Pl. V. figs. 7–7*b*).

Corallum explanate, more or less incrusting, with a wide, free edge; extremely solid, from 5 to 7 mm. thick quite close to the margin, becoming quite thick at the central part; the margin very sharp-edged. The under surface irregularly and faintly undulate, with distinct, sharp, more or less concentric edges as though produced by separate lines of growth, faintly and finely striate with very closely crowded, minute, regular, radiate costæ. Upper surface somewhat unevenly raised and depressed, with calicles sometimes arranged in irregular, more or less distinct series, but never elevated at the lower border so as to become oblique. Calicles generally irregularly placed, subcircular or subpolygonal, small, from 1·5 to 3 mm. in diameter, rather shallow, close, even at the margin, separated by rounded interstices which are quite narrow or rather broad (from 1 to 2·5 mm. wide) over which the septa are continuous from centre to centre. Three cycles complete, a fourth often present and incomplete. The septa are small, granulated, very thin and even, appearing like striations on the surface. Columella small, tuberculate. Synapticulæ small, thin, and very distinct in the marginal calicles where they are regularly placed and parallel; but becoming closer and thicker on the more central parts, and eventually fusing to form a solid wall. Endotheca very slightly developed, rudimentary.

The species is represented by a fragment about 9 cm. long.

The form differs from the other known species of *Agaricia* in the much more scattered arrangement of the calicles; but this affords no grounds for generic separation since the arrangement of the calicles is extremely variable in the genus. It seems to have a close resemblance to the *Agaricia planulata*, though differing in numerous characters from that species.

A striking feature of the species is the nature of the synapticulæ, which are extremely

distinct on the marginal parts, close, thin, and regularly arranged in parallel lines; but which, as the growth proceeds, become gradually thicker and closer, and eventually fuse to form a broad, rounded, solid wall. The costal area is also peculiar owing to the sub-concentric sharp edges which mark it, and which would appear to have been produced by separate periods of growth.

Through this form the genus *Agaricia* is closely related to *Siderastræa*.

Locality.—Levuka.

Family Cycloseridæ.

Genus 1. *Cycloseris*, Milne-Edwards and Haime.

Cycloseris et *Diaseris*, Milne-Edwards and Haime, Cor., iii. pp. 49, 54.
„ „ Duncan, Rev. Madrep., pp. 149, 150.

I have placed *Diaseris* as a synonym of *Cycloseris*, since I am convinced that the curious forms which have been referred to that genus are nothing more than broken pieces of specimens of *Cycloseris*, which in this broken condition have continued living, and have, in part or wholly, repaired the injury.

The early view which was held by Milne-Edwards and Haime as to the constitution and formation of these curious forms, namely, that in the young state the specimens have the form of separate pieces or lobes, and that these unite irregularly during growth, has long ago been proved by Semper to be untenable; and indeed one is inclined to wonder that such an opinion, with all that it implies for the formation of those structures, should have been advanced by such writers as Milne-Edwards and Haime.

Tenison-Woods has already noticed the extremely close relationship between the two genera, though the formation of the specimens of the so-called *Diaseris* did not strike his attention.

Specimens in the Challenger collection and in the collection of the British Museum show well the different shapes and degrees of growth of the forms; and in the Challenger collection occur two perfect specimens of *Cycloseris* (*Diaseris*) *freycineti*.

Owing to the thinness and delicacy of the small and large specimens of the greater number of the recent species of *Cycloseris*, and especially owing to the thinness of the wall, such specimens would be very easily broken, whether by the action of various animals or by the play of winds and waves; a liability which is much increased by the fact that these delicate corals are not attached—at any rate not except, perhaps, in their very young stages. And this seems to me sufficient to account for the fact that so large a proportion of distorted and mended or broken specimens are found in comparison with the perfect specimens.

Such reparation of injury is very common among the Fungidæ; and injury to the

corallum is very common among these forms owing to the fact that the members are unattached except in their very young stages—*Podabacia* excepted. Such injury and consequent reparation are frequently met with in *Fungia*, *Halomitra*, *Herpetolitha*, and *Lithactinia*, and occasionally in *Podabacia* and *Cryptabacia;* though the thickness of the corallum in the larger number of cases would prevent the fracture giving rise to many pieces, and hence the growth resulting from injury in these forms would seldom, if ever, present the complicated arrangement found in the repaired forms of *Cycloseris*.

According to the size and shape of the fragment, would be the shape and relative size of the different parts of a repaired form. If the specimen broken be quite small, its adult repaired form, though showing the lines of fracture or interrupted growth, will take on most closely the circular shape of the perfect specimen, and such forms as these are extremely common in the *Cycloseris distorta* and *Cycloseris freycineti*. When the fracture occurs in specimens that are larger, but yet not adult, the adult repaired specimen presents marked inequality between the older and the later growth on the two sides; and this condition is again extremely common among specimens of the above species. Complication of parts may arise in both of these cases, by additional or subsequent fracture in the repaired specimen. A very common condition met with is that in which smaller or larger pieces are found, in which reparation has not yet taken place or has just begun, the new growth in the later case being found almost invariably to be in a direction at right angles to the line of fracture of the specimen along the whole course of this line. If the specimens broken be large this condition persists in the repaired form; if the specimens be small it becomes much altered in the course of growth, the septa becoming inclined at a gradually lessening angle along the original lines of fracture.

In a large series of specimens of *Cycloseris distorta* and *Cycloseris freycineti*, it is easy to recognise the various steps as above described, which force one to the only explanation that is possible of their origin and development.

Six species of the genus were obtained.

1. *Cycloseris distorta* (Michelin).

Fungia distorta, Michelin, Mag. de Zool., v. (Zooph.), pl. v., 1843.
Diaseris distorta, Milne-Edwards and Haime, Cor., iii. p. 55, pl. D. 12, fig. 4.
„ „ Semper, Zeitschr. f. wiss. Zool., Leipzig, xxii. pl. xxi. fig. 2.

Two pieces of separate specimens were obtained, one of which is about 5 cm. in diameter.

Locality.—Santa Cruz Major Island, off Samboangan, Philippines, 10 fathoms.

2. *Cycloseris tenuis* (Dana).

Fungia tenuis, Dana, Zoophytes, p. 290, pl. xviii. fig. 1.
Cycloseris tenuis, Moseley, Chall. Rep. Deep-Sea Corals, p. 190, pl. x. fig. 6.

It is with extreme doubt that I have retained this species. I am of opinion that it is but the circular and normal form of *Cycloseris* (*Diaseris*) *distorta*, which name claims priority and should therefore be substituted for it.

A large specimen was obtained, the longer diameter of which is about 6 cm. The species in its earliest stages is hexahedral, then dodecahedral, owing to the enlargement of the secondary septa; it is ultimately subcircular or slightly elliptical.

Cycloseris hexagonalis, Milne-Edwards and Haime, appears to be identical with this species.

Locality.—Samboangan, Philippines.

3. *Cycloseris cyclolites* (Lamarck).

Fungia cyclolites, Lamarck, Hist. Anim. sans Vert., ii. p. 236, 1816.
Cycloseris cyclolites, Milne-Edwards and Haime, Cor., iii. p. 50, pl. D. 12, fig. 3.

A large, dead, and worn specimen was obtained, which does not appear to differ at all from this species. Though the dentation of the septa is destroyed, yet the characters of the lower surface are sufficient to fix the generic position of the specimen. It is by far the largest form of this species which has hitherto been obtained, being 10 cm. in the long axis and nearly 9 cm. in the short axis; it is about 4 cm. high.

A small specimen of this species also was dredged off Santa Cruz Major Island, Samboangan, 10 fathoms.

Locality.—Samboangan, Philippines.

4. *Cycloseris freycineti* (Milne-Edwards and Haime).

Diaseris freycineti, Milne-Edwards and Haime, Cor., iii. p. 55.
„ „ Semper, Zeitschr. f. wiss. Zool., Leipzig, xxii. pl. xxi. fig. 1.

Two circular specimens of this species were collected, which show no traces either of irregular growth or of injury. One is about 3 cm. in diameter and nearly 1 cm. high, evenly convex above and concave below; the other is smaller and nearly flat. The corallum is rather thin, with the edges rounded, being from about 4 to 5 mm. thick at the centre, and about 2 mm. thick at the margin. The axial cavity is very pronounced, rather deep and elongated; the four lateral, primary septa are very distinctly prominent at this part, and the columella is very developed, papillose and very even. The septa are of seven complete cycles, very low, evenly and closely placed, thick and nearly subequal in the larger cycles, very thin in the last cycle, evenly and vertically perforated and trellised, with abundant and very thick granules over the whole surface, the upper

border being roughly jagged. Owing to the close and even arrangement of the septa the perforations are quite inconspicuous in a surface view of the corallum.

Locality.—Santa Cruz Major Island, off Samboangan, Philippines, 10 fathoms.

5. *Cycloseris sinensis*, Milne-Edwards and Haime.

Cycloseris sinensis, Milne-Edwards and Haime, Cor., iii. p. 51.

Four specimens, varying from 2 to 4 cm. in diameter, were obtained. The species seems well characterised by the extremely thin and delicate corallum, much more thin and delicate than in any other species of the genus, nearly acute at the margin, with extremely fine costal striations and very thin, fragile, close, numerous, fenestrated septa. The columella is slightly developed and is very finely papillose.

The form described by the Rev. J. E. Tenison-Woods as occurring in Australia, and referred by him to this species, seems to be distinct from it, and appears to be more closely allied both to *Cycloseris discus* and *Cycloseris freycineti*.

Locality.—Santa Cruz Major Island, off Samboangan, Philippines, 10 fathoms.

6. *Cycloseris discus*, n. sp. (Pl. VI. figs. 3–3*a*).

Corallum subcircular and thick, flat below, and nearly flat above, with the margin rounded and nearly as thick as the central part. Costæ very fine and finely denticulate, scarcely distinct except at the marginal parts, and appearing like striations on the surface. Septa closely and evenly placed, not elevated, giving a very neat appearance to the corallum, extremely and thickly granulated and spinulous, with a jagged border, of six complete cycles, with a seventh more or less incomplete, and occasionally with rudiments of an eighth cycle; those of the first four or five cycles not fenestrated, but thick and equal, and of varying length according to the cycle to which they belong, swollen close to their point of origin, at which point they are rather thin and acute; those of the last two cycles extremely thin, and vertically fenestrated, with a divided edge. Axial cavity very deep, oblong and narrow, definitely outlined, owing to the inner edges of the septa being nearly vertical. Columella more or less well developed, papillose and granulated.

Two specimens of this species were obtained; they form circular, thick and flattened disk-shaped coralla, which are from 2 to 2·5 cm. in diameter, and from about 7 to 8 mm. thick at centre, and from 5 to 6 mm. thick at the margin. The species seems to be close to the fossil species *Cycloseris semiglobosa* (Michelin), the figure of which, given by Michelin, is useless for purposes of identification. The description of the fossil form, however, differs in many characters from the present species.

Locality.—Santa Cruz Major Island, off Samboangan, Philippines, 10 fathoms.

Genus 2. *Trochoseris*, Milne-Edwards and Haime.

Trochoseris, Milne-Edwards and Haime, Cor., iii. p. 57.
„ Duncan, Rev. Madrep, p. 147.

The recent forms of this genus are closely similar to the young specimens of the genus *Leptoseris*, at the stage in which there is only a single central calicle. The two genera would seem to be distinguished simply by the nature of the scanty columella, which in *Trochoseris* is papillose and trabeculate, and in *Leptoseris* is tuberculate.

Trochoseris stokesi, Milne-Edwards and Haime.

Haloseris crispa, Rousseau (*non* Ehrenberg), Voy. au pôle sud de Dumont d'Urville, Zool., vol. v. pl. xxix. fig. 3.
Trochoseris stokesi, Milne-Edwards and Haime, Cor., iii. p. 58.

A portion of a corallum was obtained which, from its general structure, and from the absence of radial calicles, seems to be referable to this species. The piece does not show the calicular fossa, and apparently would form about one-third of the complete specimen. In the absence of the characters of the columella it may perhaps be doubted whether the fragment was not broken from a young specimen of a *Leptoseris* in which the radial calicles had not yet developed.

Locality.—Tahiti, from 30 to 70 fathoms.

Genus 3. *Pachyseris*, Milne-Edwards and Haime.

Pachyseris, Milne-Edwards and Haime, Cor., iii. p. 85.
„ Duncan, Rev. Madrep., p. 162.

Professor Verrill[1] considers that the name *Undaria* should be substituted for *Pachyseris;* but, as used by Oken, *Undaria* is a synonym of *Agaricia* and cannot therefore be adopted for another genus.

Pachyseris speciosa (Dana).

Agaricia speciosa, Dana, Zoophytes, p. 337, pl. xxi. fig. 7.

Two fragments were obtained which are referable to this species. The ridges are often irregular, rounded, and very slightly elevated. The columella is absent or quite rudimentary.[2]

The species is very close to *Pachyseris lævicollis*, but is quite different from *Pachyseris speciosa*, Milne-Edwards and Haime, which is evidently a new species, easily distinguished by its very acute and elevated ridges, which throughout the corallum are concave on their sides and very sharp at their margin, and by the abundant columella,

[1] Dana, Coral and Coral Islands, p. 336.

[2] See Dana's figure.

which forms a wide, continuous structure separating the ridges. This latter form has also a finer and more delicate structure than *Pachyseris speciosa*. It may be distinguished as *Pachyseris haimei*, n. sp.

Locality.—Tahiti.

Genus 4. *Cylloseris*, n. gen.

Corallum compound, consisting of more or less irregular, semi-incrusting, thin, explanate expansions, the under surface of which is faintly granulated and marked by very delicate costal striations. The upper surface very uneven, owing to the development of subconical, elevated, compact, perpendicular projections, which form neither longitudinal crests nor continuous transverse ridges, but which are often arranged in a subconcentric manner; these projections apparently formed by short, irregular, transverse flexures of the corallum at the margin, with consequent thickening and elongation by growth. The calicles are scattered and numerous, situated singly, both in the upper angle of the elevations, which consequently form large platforms below the calicles, and irregularly on the sides and extremities of the larger projections. The fossa extremely small. The parent calicle indistinguishable. The septo-costæ take the form of extremely delicate, very granulated, entire striations over the whole surface, continuous from centre to centre, giving a very even appearance to the projections. Columella tuberculate or substyliform.

The subconical or subcylindrical, elevated projections of the surface, with the almost inconspicuous cells and septa, give a peculiar appearance to this genus, and easily serve to separate it from all other Fungida. It has many points of alliance with the fossil genus *Hydnophorabacia*. This is clearly the undescribed genus referred to by Professor P. Martin Duncan in his Revision of the Families and Genera of Madreporaria, p. 164.

Cylloseris incrustans, n. sp. (Pl. VI. figs. 4–4*b*).

Corallum incrusting, often free for a large extent, much bent and contorted, and extremely thin at the margin. Costæ closely crowded, very faintly marked, almost obsolete; the under surface uneven, and closely and irregularly undulate. The projections of the upper surface are from 2 to 7 mm. high, irregular, subconical, often with an elongated base, and bent, and often continuous with one another; acute or rounded, rather close, sometimes crowded. Calicles, very small and shallow, the fossa being from about 0·5 mm. to 0·75 mm. wide; they are situated singly both at the base of each of the projections, in the upper angle, and on the larger and thicker projections. Septa of three or four cycles, often much elongated, very thin, appearing as fine striations, and scarcely distinguishable with the naked eye; continuous over the projections from centre to centre, but on the

apex of the projections very sinuous and often discontinuous. Columella well developed, rather compressed and tuberculate.

Two specimens of this species were obtained, the larger of which forms a thin, uneven, contorted plate, about 9 cm. long and 6 cm. wide, which has grown partly incrusting over a dead specimen of the same kind. At the margin it is less than 1 mm. thick, and between two of the projections the thickness is scarcely more than 2 or 3 mm. in the more central parts.

Locality.—Tahiti.

Genus 5. *Domoseris*, n. gen.

Corallum compound, consisting of broad, irregularly explanate plates, fixed at the centre, and often attached laterally by one or more irregular pedicels, which are especially developed in old specimens. The under surface imperforate, very uneven owing to irregular depressions, marked with distinct, but fine, costal striations. The upper surface very uneven, owing to numerous irregular projections, which correspond to the small depressions of the under surface; these projections are irregularly scattered and are arranged neither in longitudinal crests nor in transverse ridges. The calicles are numerous, scattered, developing singly both in the upper angle of the projections and on the extremities and sides of the larger ones; the parent calicle nearly or quite indistinguishable. Septo-costæ very uneven and distinct, continued nearly straight to the margin from adjoining calicles, but on the projections on the lower sides of the calicles, and throughout nearly the entire portion of the rest of the corallum, and more especially on the older parts, they become very irregularly thickened and swollen, shortly discontinuous, twisted, bent and contorted. Columella tuberculate, nearly inconspicuous.

This peculiar genus is well characterised by the nature of the septo-costæ, which present a decided approach to the structure found in the genus *Psammocora*. Owing to this peculiar structure, the projections are very different from those of the genus *Cylloseris*. The presence of the elevated projections, and the nature of the septo-costæ separate the genus from *Leptoseris*, which it somewhat resembles at the extreme marginal parts, where the projections are less marked and the septo-costæ more uniform.

Three species of the genus are in the collection.

1. *Domoseris porosa*, n. sp. (Pl. V. figs. 4–4*c*).

Corallum broad, explanate, thick, being about 15 mm. thick towards the centre, and from 5 to 8 mm. at about a distance of 3 cm. from the margin, slightly concave and irregularly shallow-vasiform above, chiefly composed of an abundant, trabeculate tissue derived from the perforated septa and the crowded synapticulæ; fixed below by many

supplementary bases of attachment. The depressions and prominences of the under surface small, irregular and numerous. Costal striations distinct, fine and subequal. Calicles very irregularly and unevenly placed, often crowded, frequently grouped into rather large, nodular masses over the surface, especially on the older parts, owing to the development of calicles on the projections. The fossa small and deep, from about 0·75 to 1·5 mm. in diameter. Septa apparently of three cycles, very close, small and unequal and unequally raised, granulated and perforated except at the extreme basal part. Septo-costæ almost straight at the marginal part of the corallum, and divided into more or less irregular, rather large, rounded teeth; but throughout the rest of the corallum, they are irregularly discontinuous, bent, sinuous and contorted, rather thin or irregularly swollen, thick and tuberculate, unequally toothed and prominent, more frequently so below the calicles, so that the surface has a rough and very uneven and irregular aspect. Columella small, deep down in the fossa, and not conspicuous. The synapticulæ are extremely well developed and abundant, subparallel, and separated by spaces about equal to their own diameter, clearly seen both in transverse and longitudinal section, and fused only throughout a thin basal lamina.

This species shows well the typical structure of the genus, which in its youngest stages is closely allied to the genera *Agaricia*, *Leptoseris* and *Trochoseris*, but which with growth becomes more clearly related in its adult forms to the genus *Psammocora*.

It is represented in the collection by a large portion (evidently broken off a large specimen), and by two small pieces.

Locality.—Tahiti.

2. *Domoseris solida*, n. sp. (Pl. V. figs. 5–5*a*).

Corallum broad, explanate, of a very dense and solid texture, thin, from about 8 to 10 mm. thick at the central portion, much thinner towards the margin, irregularly shallow-vasiform, with supplementary basal attachments. Under surface very finely striate, with very small and irregular depressions and prominences. Calicles very unevenly and irregularly placed, often crowded, and frequently grouped into small, nodular masses, due to the development of calicles on the projections of the surface. The projections are from 3 to 7 mm. in height and width, and are very uneven, more or less perpendicular to the surface and generally distinctly isolated. The fossa is rather deep and from about 0·75 to 1·5 mm. wide. The septa of two or three cycles, small, unequal, close, very granulated and solid. The septo-costæ in many parts are nearly straight especially towards the margin, alternately rather large and small, with an uneven border seldom divided into distinct teeth; towards the central parts, and more especially on the projections, they are more or less discontinuous, irregularly thickened, bent, sinuous, contorted and unevenly prominent, so as to give a rather rough aspect to the projections.

Columella tuberculate, distinct. Synapticulæ rarely conspicuous, fused throughout so as to give a close and dense texture to the corallum.

This species may be easily distinguished from *Domoseris porosa* by the rather finer striations of the under surface, by the more isolated projections of the upper surface, by the non-perforated septa, by the thinner, nearly entire, less swollen and less irregularly discontinuous septo-costæ, by its rather conspicuous columella, and by the fused state of the synapticulæ. It has many points of general resemblance to *Leptoseris* (*Mycedium*) *elegans* (Milne-Edwards and Haime), but differs from it in essential structure.

A single large specimen is in the collection.

Locality.—Tahiti.

3. *Domoseris regularis*, n. sp. (Pl. V. figs. 6–6*b*).

Corallum broad, explanate, irregularly bent, thin, from about 4 to 5 mm. thick at a distance of about 8 cm. from the margin, and very thin at the extreme marginal parts; with supplementary basal attachments. Under surface with well-pronounced depressions and prominences marked by fine costal striations. The calicles irregularly scattered, not crowded, and rarely or not at all grouped into nodular masses, the projections being low and rather small; the fossa small, about 1 mm. wide, rather deep. The septa of two or three cycles, unequal, close, very granulated, perforated; the septo-costæ nearly evenly raised, alternately very much thickened, with a rounded upper margin divided into rather unequal, broad, blunt teeth; often discontinuous, and, more especially below the more central calicles, very irregularly bent, sinuous and contorted. Columella small, inconspicuous. Synapticulæ small, irregularly developed, not abundant, nor fused throughout to form a continuous, solid lamina except quite at the base.

This species is easily distinguished from the *Domoseris solida* by its distinctly toothed and more unequal, perforated septa, by its non-fused synapticulæ, and by the less elevated and more distant projections of the upper surface. From the *Domoseris porosa* it is distinguished by the very thin corallum, by its much less uneven and scarcely rough surface, due to the more evenly raised and more equally thickened septo-costæ, which are much less discontinuous and contorted, by the much less perforated nature of the septa, and by the comparatively slight and irregular development of synapticulæ.

Only a fragment of a large specimen, and a very small specimen, were obtained. The small specimen is from about 2 to 3 cm. wide, irregularly shallow-vasiform, attached to and incrusting a portion of a shell. It contains about four distinct calicles which have the lower border scarcely at all raised, with the septo-costæ irregularly toothed and subentire. Its growth has been much interrupted by foreign matter, so that the parent calicle does not occupy a central position.

Locality.—Tahiti, 30 to 70 fathoms.

Genus 6. *Psammocora*, Dana.

Psammocora, Dana, Zoophytes, p. 344.
„ Milne-Edwards and Haime, Cor., iii. p. 219.
„ Duncan, Rev. Madrep., p. 192.

Recent investigation has shown that this genus must be placed under the Fungida and not under the Perforata, as in the system of Milne-Edwards and Haime.

Three species are in the collection.

1. *Psammocora exesa*, Dana.

Psammocora exesa, Dana, Zoophytes, p. 348, pl. xxvi. fig. 1.

A small specimen of this species occurs in the collection. It is a broken specimen, with short and thick, obtuse lobes; the surface is roughened by irregular, low, somewhat sinuous, obsolescent ridges, between which the cells are placed either singly or in groups. The cells are generally very shallow and indistinct; and the septa are from ten to twenty in number, uniformly very thin and finely granular, often very small, and united with each other. The surface between the cells is of very open and porous texture, having the form of oval or elongated, rectangular, interseptal areas, arranged somewhat as in a spider's web, an arrangement apparently due to an abundant and regular development of synapticulæ.

Locality.—Amboina.

2. *Psammocora obtusangula* (Lamarck).

Pavonia obtusangula, Lamarck, Hist. Anim. sans Vert., ii. p. 240, 1816.
Psammocora obtusangula, Dana, Zoophytes, p. 345.

A large, broken specimen was obtained, which is in all respects typical of the species.

Locality.—Tongatabu.

3. *Psammocora ramosa*, n. sp. (Pl. VI. figs. 6–6*b*).

Corallum consisting of a cluster of numerous, rather thick, elongated, uneven, and somewhat contorted branches which spring from a thick, basal stock; the branches are subterete, much and rather closely divided, not coalescent, from 8 to 12 mm. thick; continued above into short, irregular, compressed, clavate, or palmate branchlets, the terminal divisions being rather thick and obtuse, and often terete; the corallum throughout is somewhat irregularly swollen or nodose owing to unequal rudimentary branches and branchlets. Calicles very small, 0·75 mm. wide, rather distant, superficial, with a minute depression at the centre, in which a very minute tuberculate

columella is sometimes distinguishable. Septa generally eight or nine, very variable, oval or cuneate, and very roughly granulated, thick, often alternately united by the outer part, and thus enclosing the intervening ones. The surface between the cells is divided up into irregular, closely-placed, rounded or oval, septa-like lobes which give a peculiar appearance to the corallum.

This species seems to be close to the *Psammocora parvistella*, Verrill; but the characters of the calicles and the intercalicular spaces will easily distinguish it. The specimen is from about 9 to 10 cm. high, and 10 to 11 cm. wide.

Locality.—Samboangan, Philippines.

Genus 7. *Stephanaria*, Verrill.

Stephanaria, Verrill, Trans. Connect. Acad., vol. i., 1868, p. 545.
„ Duncan, Rev. Madrep., p. 160.

The essential distinction of this genus from *Psammocora* is to be found in the nature of the columella, which is papillary; but it is doubtful whether this character in these forms can be considered sufficient for generic separation.

Stephanaria stellata, Verrill.

Stephanaria stellata, Verrill, Trans. Connect. Acad., vol. i. p. 545, pl. ix. fig. 4.

Two small specimens, apparently referable to this species, occur. They are interesting varieties, in which the branches are more elongated than in the Panama or Californian forms. (Reference to the distribution of this species is made under the genus *Porites*.)

Localities.—Honolulu; Kandavu, Fiji.

Genus 8. *Oxypora*, Kent.

Oxypora, Saville Kent, Proc. Zool. Soc. Lond., 1871, p. 283.

This genus was proposed by Kent for the *Trachypora* of Verrill, the name *Trachypora* being already in use for a distinct genus of fossil Corals. Klunzinger has since proposed *Echinophyllia* for the same genus, but *Oxypora* claims priority. By a slip, this genus has been placed as a synonym of *Phyllastræa* by Professor Duncan, while *Trachypora* is retained.

Oxypora contorta, n. sp. (Pl. V. figs. 2–2*b*).

Corallum large, explanate, suberect and foliate, thin, very contorted, the twisted parts uniting to form large, hollow tubes, which in course of growth become closed above; pierced with irregular openings, which become larger and more numerous towards the margin. The under surface roughly and irregularly costate, the costæ being unequal, slightly thickened, a little prominent, and finely but strongly spinose,

often lacerately divided. The upper surface covered by unequal, narrow, subparallel septo-costal plates, which are very strongly and raggedly divided towards the margin, and scarcely divided at the basal parts except in the immediate vicinity of the calicles. The calicles are from about 5 to 6 mm. in diameter, generally very closely crowded against each other, but sometimes rather scattered; the septa are of two distinct cycles, very unequal, remarkably exsert and deeply divided into narrow, unequal, lacerate lobes and spines, which give a very ragged appearance to the corallum.

The species is close to *Oxypora lacera*, Verrill, but can be easily distinguished, among other characters, by the arrangement and structure of the calicles.

A single large specimen was obtained.

Locality.—Amboina.

Family Fungidæ.

Genus 1. *Fungia*, Lamarck.

Fungia (pars), Lamarck, Syst. Anim. sans Vert., p. 369, 1801.
„ Milne-Edwards and Haime, Cor., iii. p. 5.
„ Duncan, Rev. Madrep., p. 141.

As already pointed out by Professor Duncan, *Lobactis*, *Pleuractis*, and *Ctenactis*, are synonyms of *Fungia*.

Very important observations, confirmatory of those by Stutchbury and by Semper, have been made by Professor Moseley on the development of the young *Fungia*,[1] and it seems extremely desirable to insert here his account of them.

"A Mushroom Coral (*Fungia*) is very common all over the reefs at Tahiti. After much search, I found one of the nurse-stocks from which the disc-shaped free corals are thrown off as buds, as was originally shown by Stutchbury, and confirmed by Semper, who considers the case to be an instance of alternation of generations.

"Though the free Corals were so extremely numerous, I could only find the one nurse mass. It, as in Stutchbury's specimen, consisted of a portion of a very large dead *Fungia*, to which were attached all over numerous nurse-stocks in various stages of growth. Some of those in the specimens have only just developed from the attached larva, and have as yet thrown off no buds. A small cup-like Coral is formed, and as it grows the mouth of the cup widens and assumes somewhat the form of the adult disc-shaped free Coral, but is still distinctly cup-shaped. A line of separation forms in the stem of this bud, and the bud falls off; a fresh bud then starts from the centre of the scar left by it on the stock, and the process is repeated. The fresh bud in its growth does not spread its attachments over the whole surface of the old scar, the margins of which persist as a dead zone around the base.

[1] Notes by a Naturalist on the Challenger, p. 524.

"The line of separation of the second bud does not correspond with that of the first, but is beyond it a short distance. Hence the nurse-stem which has thrown off several buds is transversely jointed in appearance. Some of the stems in the specimens I found showed thus three rings. Stutchbury imagined that each mother stock threw off only one bud and then died; Semper showed that this was not the case, he speaks of three or four generations only being produced by each stock. Apparently the number produced is very limited. None of the stocks in my specimens were branched. A young Coral bud just ripe, $1\frac{1}{6}$th of an inch in diameter, dropped off one of the stocks as I lifted the specimen from the water. Beneath it, on the scar, another very small young *Fungia* had begun to bud out before its predecessor was quite free. The somewhat cup-shaped buds, when set free, become, by the direction in which future growth takes place, flat and disc-shaped and develop eggs, from which spring free-swimming larvæ, which start fresh stocks.

"The mass of nurse-stocks which I found was surrounded on the reef by a group of fully-formed Fungias of all sizes; I counted twenty in all. Some six of these were small and still showed the scar of attachment which disappears in the process of subsequent growth."

An essential part of the definition of *Fungia* is, that in the adult state the animals are simple forms; and normally this is the case. It very frequently happens, however, that specimens are found in which two or even three distinct mouths are present in the same specimen, and examples of this are found in the collection; but a careful examination shows that this arises from interrupted growth or injury, and must be looked upon as accidental and not normal to the genus.

Professor Duncan has very thoroughly investigated the structure of the hard parts of *Fungia* and other allied genera, with especial reference to the structure and nature of the synapticulæ, which were considered by Milne-Edwards and Haime to be structures analogous to extremely developed granules.

These synapticulæ, he concludes, "are not hypertrophied granulations, from which they differ in shape, position, and structure."[1] Professor Duncan considers that they are independent structures, which by their fusion with one another and with the septa give rise to the basal wall. Thus, "it appears that synapticulæ are formed either prior to or simultaneously with the septum, for they and it contribute to the basal wall before the septum has increased much in height;"[2] "they (*i.e.*, synapticulæ) increase beyond the normal dimensions towards the base, and unite in a homogeneous mass composing the basal wall;"[3] "the section indicates that the wall is composed of more or less horizontal or curved synapticulæ, thicker than others, above."[4]

While it seems proved that these synapticulæ are not hypertrophied granules, but structures independent of the granules, it seems to me that, instead of being independent structures which give rise to a basal wall, it is likely, if not more probable, that they are modified or specialised portions of the wall itself, which thus gives rise to synapticulæ

[1] *Journ. Linn. Soc. Lond.* (Zool.), vol. xv*ii*. p. 147. [2] *Ibid.*, p. 145. [3] *Ibid.*, p. 147. [4] *Ibid.*, p. 144.

instead of being derived from them. This indeed seems borne out by the structure of the corallum of the very young forms which are still attached to the nurse-stock. In these the walls are well developed and almost imperforate, while the synapticulæ are comparatively undeveloped. Additional evidence for this view can also be drawn from the relation of the synapticulæ to the wall in many forms of the Cycloseridæ and Plesiofungidæ, in which, while it is convenient and is customary to speak of the walls of the smaller developing calicles as being formed by the upgrowth, the increase in size, and the fusion of the synapticulæ (as though these structures were distinct from the wall in their origin), it must be remarked that the synapticulæ appear to be direct interseptal outgrowths of the wall (as in *Agaricia*, *Tichoseris*, *Domoseris*, &c.); so that the statement that the walls are synapticulate, or that the walls are formed by the fusion of synapticulæ, would appear to mean nothing more than that the different parts of the wall which are deposited separately (and are then called synapticulæ) enlarge during growth and fuse to form a solid, more or less continuous mass, which is the more commonly known "wall."

It must be confessed, however, that conclusions as to the relations of these parts are practically but guesses at the truth of the matter; proofs of such relations in this, as in so very large a number of other cases among the Corals, can only be obtained when the development of these different structures from the soft parts in the young forms have been thoroughly investigated.

A remarkable degree of variation seems to characterise the different forms of *Fungia*, as is well evidenced by specimens in the collection; and our knowledge of constant specific characteristics and limitations, if such indeed exist, is very imperfect in these as well as in the other Reef-Corals.

From their great size and weight, and their unattached condition, the species of *Fungia* offer apparently the most suitable examples on which continuous and detailed observation and experiment may be made; while their remarkable abundance and peculiarly favourable position on the reefs at Banda and Tahiti would seem to point to such localities as being the best adapted to such investigation. It is certainly a promising field for any naturalist who, with time and means at his disposal, would devote himself to it.

Thirteen species of this genus are in the collection.

1. *Fungia patella* (Ellis and Solander).

Madrepora patella, Ellis and Solander, Zoophytes, p. 148, pl. xxviii. figs. 1, 2, 3, 4.
Fungia agariciformis, Leuckart, De Zooph. Corall., p. 42, pl. iv. figs. 1–4.
„ *agariciformis*, Dana, Zoophytes, p. 292, pl. xviii. figs. 5, 6.
„ *patella*, Milne-Edwards and Haime, Cor., iii. p. 8.
„ *patella*, Klunzinger, Cor. roth. Meer., p. 61, pl. vii. fig. 4, and pl. viii. fig. 2.

Some very large and two small specimens of a variety of this common species were obtained. The septa are very thin at the upper border, with very small teeth. The

basal parts of the septa are much thicker, and the costæ are rather thick, crowded, and subequal, with strong and pointed spines, especially in the old specimens. One small specimen from Mactan Island shows well the scar of attachment.

Fungia pliculosa, Studer, is extremely close to this species, and is probably not distinct from it.

Localities.—Banda; Mactan Island, Philippines; Amboina.

2. *Fungia discus*, Dana.

Fungia discus, Dana, Zoophytes, p. 291, pl. xviii. fig. 3.

A large series of specimens was collected, which present considerable differences among themselves, but which are evidently only varieties of the same species. The corallum may be nearly flat on both sides or convex, and often strongly so; the costæ may be slightly or very prominent, distinctly radiate to the very centre or almost obsolete, with obtuse or almost subacute, irregularly crowded, or scattered spines, which are sometimes nearly suppressed; the septa may be thin or much thickened and dense, straight or slightly crinkled and closely plicate, strong or subfragile, very closely placed with an even appearance, or more unequal and irregular, with very irregular teeth, which are either small or large, acute and narrow, or broad and subdivided at the apex into very minute denticulations. Owing to this great variation in the species, some forms seen separately seem almost sufficiently distinct to be made separate species, but in the series it is impossible to separate them.

One specimen of this species in the collection, the corallum of which has been broken in three distinct places, possesses three mouths situate at the points of fracture, and shows very clearly the formation of new mouths by the animal during subsequent growth after injury of considerable extent to its structure has taken place.

To this species belongs the nurse mass obtained and described by Professor Moseley.[1]

Locality.—Tahiti.

3. *Fungia concinna*, Verrill.

Fungia concinna, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., vol. i. p. 50.

Two specimens of this species were obtained. They agree in every essential respect with the description of Verrill, but they differ slightly in that the teeth of the septa are unequal, many small, acute teeth being often found between the large acute ones, and not infrequently passing gradually into one another.

The species is extremely close to the larger-toothed, convex forms of the *Fungia discus*, while, as pointed out by Verrill, it is also allied to the *Fungia repanda*. In the three species the peculiar ornamentation of the lateral surfaces of the septa is the same,

[1] Notes by a Naturalist on the Challenger, p. 524.

and takes the form of minute granules or spinules below, becoming more or less striate in wavy lines, often thickened, which follow the dentation of the septa. Though apparently distinct, it seems likely that the three species are but extreme forms of one and the same species.

Locality.—Tahiti.

4. *Fungia repanda*, Dana.

Fungia repanda, Dana, Zoophytes, p. 295, pl. xix. figs. 1, 2, 3.

One specimen from Amboina has the septa quite thick, solid and strong, and not infrequently with a sharp somewhat trenchant edge. A series of specimens from Banda shows a very great variation, in which the septa become gradually thin, and, especially in the smaller specimen, quite fragile and delicate. A small specimen of this series presents marked differences in its delicate characters from the ordinary form of the *Fungia repanda*, but viewed in the series to which it belongs it is impossible to separate it.

Localities.—Amboina; Banda; Mactan Island, Philippines.

5. *Fungia confertifolia*, Dana.

Fungia confertifolia, Dana, Zoophytes, p. 297, pl. xix. fig. 5.

Two specimens of this species were obtained. The extremely crowded, even, and undulate lamellæ are very characteristic; in young specimens where the lamellæ are thinner, wider apart, and more unequal, the species very closely resembles the *Fungia patella*, but with age the septa become quite thick, with strong teeth, and the costal spines quite long and large. Distinctly raised tentacular teeth are present, but they are never strong and thickened as in *Fungia dentigera*. A very common characteristic, generally found on several parts of the specimen, is the unequal and suppressed nature of certain septa, resulting in the convergence and coalescence of the outer ends of the septa on each side. A moderately large, interesting variety from the Fiji Islands shows the septa much thickened, bearing rather large, blunt, irregular teeth.

Localities.—Banda; reefs, Fiji.

6. *Fungia horrida*, Dana.

Fungia horrida, Dana, Zoophytes, p. 298, pl. xix. fig. 7.

Two specimens were obtained which, though differing in a few points from those described by Dana, seem referable to this species. The costæ are prominent, sub-lamellate and thick, deeply divided into long, often contorted and branched spines, which, in old specimens, become very crowded, irregular and thickened, and are often placed over the whole of the lower surface. The septa are thick, and very roughly

divided, those of the last cycle less distinctly so. They are not closely crowded, and are rather unequally raised. The tentacular teeth are not developed on any of the septa. The whole corallum has a very dense and compact structure.

In the smaller of the two specimens a second mouth has formed at a short distance from the centre, just where a fracture of the corallum has taken place.

Locality.—Tahiti.

7. *Fungia valida*, Verrill.

Fungia valida, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., vol. i. p. 51.
Fungia valida, Klunzinger, Cor. roth. Meer., iii. p. 62, pl. viii. figs. 7, 8.

A single large specimen was obtained, which seems referable to this species. It differs from the Indian Ocean form in its much more unequal septal teeth, which are less acute and are often rounded.

The species has many points of agreement with the *Fungia horrida*, but differs in the more unequal septa and in the form of the septal teeth, which in that species are eroso-dentate and irregular.

Locality.—Reefs, Fiji.

8. *Fungia acutidens*, Studer.

Fungia acutidens, Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1877, p. 649, pl. iv. fig. 13.

Three specimens of this species were collected. The costæ are very distinct and very uniformly radiate, extending nearly to the centre, and sublamellate and prominent towards the margin, evenly divided into cylindrical blunt spines, the ends of which are very granulated or finely spinulose. In young specimens the centre is nearly bare.

The species is close to the *Fungia horrida*, but differs in its less remote, thinner, and less unequal septa, and in its closer and more regular, spinose costæ.

Locality.—Tahiti.

9. *Fungia rugosa*, n. sp. (Pl. VI. figs. 2–2*a*).

Corallum circular, somewhat undulate, slightly concave below and convex above. Costæ in distinct radial rows nearly to the centre, very unequal; the larger costæ, for about half the radius, are very prominently lamellate, rather thin at the margin, becoming less lamellate within and thickened, not continued to the centre (except probably in large and old specimens); alternating with these large costæ are others which are nearly as large, less prominent and less prolonged, while between them are placed from three to four

very small ones, which are only distinct quite at the margin, where they are separated by long slits; the surface below is very slightly perforated, having a very dense and smooth appearance, especially at the centre, which is very sparsely marked with small costal spines (probably much enlarged in old specimens); the spines on the costæ are very irregular, crowded, ragged, elongated, often 5 mm. or more in length, bent or contorted, and often clustered and divided; they are slender or thickened, not sharp, but more or less divided at the apex into numerous fine, irregular spinules, which are also sparsely placed throughout the length of the spines and are faintly visible to the naked eye. Seven cycles of septa complete, an eighth more or less incomplete. The septa are rather thin, unequally thickened at the central part, becoming nearly equal at the margin and more or less equally raised, except those of the last cycles; the primaries and secondaries equal, very suddenly thickened near the inner margin, where those of opposite sides are closely approximated, so as nearly to touch above; the tertiaries nearly as large. The teeth of the septa are peculiar; the margin of the free border of the septa is slightly wavy, and the teeth appear as the projecting ends of opposite lateral thickenings, which are continued downwards on the face of the septa for about 3 or 4 mm. Except on the last cycle, the teeth are subequal, crowded, somewhat irregular, rather short, small and acute, but finely pointed, being broader across than in the direction of the septa. Fossa elongated, narrow above, but rather wide below, owing to the crescentic shape of the septal ends; columella rudimentary.

This species is very distinctly marked both by the characters of its costæ and of its septa. The waviness and plication of the margins of the septa recall the structure often seen in delicate specimens of *Fungia patella*, while the nature of the teeth brings to mind *Fungia scruposa*. The costal characters resemble those of *Fungia horrida* in many respects.

Two specimens were obtained, which are from about 10 to 11 cm. in diameter.

Locality.—Tahiti.

10. *Fungia plana*, Studer.

Fungia plana, Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1877, p. 650, pl. iv. fig. 15.

A single specimen of this species was obtained. It is somewhat elongated and quite flattened. The species is extremely close to the *Fungia serrulata*, Verrill, and probably it is not distinct from it.

Locality.—Banda.

11. *Fungia scutaria*, Lamarck.

Fungia scutaria, Lamarck, Hist. Anim. sans Vert., ii. p. 236, 1816.
„ „ Dana, Zoophytes, p, 301, pl. xix. fig. 10.
„ „ Klunzinger, Cor. roth. Meer, iii. p. 65.

A very fine series of specimens of this species was obtained. In some specimens the corallum is much elongated, while in others it is subcircular or subtriangular with rounded edges. They are usually much thickened, especially so with age. The costæ are generally very distinctly radiate to the very centre, close and prominent, divided into rather blunt, papilliform teeth, which are very closely crowded, The septa are rather thin, subentire or finely toothed, the teeth being small, crenulate, or broadly angular, especially towards the margin of the corallum. In other specimens, however, the costæ are less prominent and less crowded, with fewer, sharper spines, which are more or less sparse over the centre, while the septa become thinner and more sharply and finely toothed. On account of these characters it must be observed that the species becomes very similar to *Fungia paumotensis*, and it is a matter of great difficulty to distinguish between them.

Fungia carcharias, Studer, is apparently identical with this species.

Figures, apparently of this species, showing the form of the corallum, are given both by Seba[1] and by Rumphius,[2] while a very good description is given by Dana. The distinction given by Milne-Edwards and Haime[3] between this species and *Fungia paumotensis* is confusing, and seems to be the reverse of what is really the case.

Locality.—Tahiti.

12. *Fungia paumotensis*, Stutchbury.

Fungia paumotensis, Stutchbury, Trans. Linn. Soc. Lond., vol. xvi. p. 485, pl. xxxii. fig. 6, 1833.
„ „ Dana, Zoophytes, p. 300, pl. xlix. fig. 8.

It is with extreme doubt that I have retained this species. It seems to me to be only a variety of *Fungia scutaria* with the corallum more elongated and flattened, with the costæ less prominent and less closely placed, bearing smaller, sharper and more distant papillæ less radiate on the centre, and with rather thinner septa, which are subentire or lined with extremely fine teeth. Numerous specimens of the species were obtained, some of which are more or less intermediate in characters between the more defined forms of the two species. Professor Martin Duncan has already pointed out the extremely close relationship of the two species.[4]

Localities.—Tahiti; Samboangan, Philippines.

[1] Thes., iii. pl. cxii. figs. 28, 29, 30.
[2] Herb. Amboin, vi. pl. lxxxviii. fig. 4.
[3] Cor., iii. p. 17.
[4] *Journ. Linn. Soc. Lond.* (Zool.), vol. xvii. p. 146.

13. *Fungia tenuidens*, n. sp. (Pl. VI. figs. 1–1*a*).

Corallum irregularly elongated, rather thin, convex above, markedly trough-shaped below; the central portion more or less flattened, solid, and seldom or inconspicuously perforated, covered by distinctly radiated and sharply spinulose costæ which become very distinct at the inclined margin. The growth at the margin more or less irregular, owing to the elongation and approximation of certain septa and the partial or complete suppression of others between them, with or without the union of the adjacent ones. Septa of very many cycles, very unequal in length, closely crowded and even, extremely thin and delicate, very flexuous, with their sides strongly granulated, especially in the smaller ones, and marked above by very minute serrations. The tentacular teeth very exsert and distinct, developed even in the last cycle, very thin, scarcely or not at all thicker than the septa, more or less rounded. Fossa elongated, rather narrow and deep; columella rudimentary.

A single small specimen, which is from about 8 to 9 cm. long, of this very distinct form was obtained. It must be placed close to *Fungia conferta*, Verrill. The very thin, delicate and flexuous septa, the very exsert and distinct but scarcely or not at all thickened tentacular teeth, the very irregular outline of the corallum, due to the unequal elongation of certain septa and the diminution or suppression of those between them, give a striking appearance to this species.

Locality.—Ternate, Moluccas.

Genus 2. *Halomitra*, Dana.

Halomitra, Dana, Zoophytes, p. 341.

This genus has lately been extended by Professor Duncan to include *Podabacia* of Milne-Edwards and Haime,[1] since, on the authority of those authors, it is stated that *Halomitra* differs from *Podabacia* simply in its general form, and in its unattached condition:[2] characters which, as Professor Duncan points out, are not sufficient for generic separation. Between *Halomitra pileus*, Dana, and *Podabacia crustacea*, however, there exist very important and striking differences apart from the simple difference in their habit, differences which entitle them to generic separation, and which were confounded by Milne-Edwards and Haime, owing to the fact that under the *Fungia pileus*, Lamarck (and under the *Halomitra pileus* of Milne-Edwards and Haime), were included two correspondingly distinct, but similarly-shaped, types of structure.

The genus *Halomitra*, as defined by Dana, is certainly a well-characterised one; and an essential part of the definition, which separates the genus from *Podabacia*, is derived from the nature of the wall and costæ. In the definition given by Dana, the under surface is tersely stated to be "*stoutly and very crowdedly radiately echinate*," that is, the wall is solid and but very slightly perforated, while the costæ form distinct,

[1] *Journ. Linn. Soc. Lond.* (Zool.), vol. xvii. p. 155. [2] Cor., iii. p. 20.

close and thick, radiating structures, which are divided up into strong spines or teeth, so as to be stoutly and crowdedly echinate. In fact, the condition of the wall and costæ, in this compound form, exhibits the closest resemblance to that which obtains in the simple genus *Fungia*, a form from which *Halomitra* may at once be derived by the development of secondary or daughter calicles around the central primary calicle.

Comparing this characteristic condition of *Halomitra* with that which obtains in the species for which the genus *Podabacia* was instituted by Milne-Edwards and Haime, namely, the *Madrepora crustacea*, Pallas (=*Pavonia explanata*, Dana), we find an essential and fundamental distinction. This was clearly recognised by Dana, who states that the under surface is "*echinulato-striate and porous*," that is, that the wall is not solid, but finely and closely porous or fissured throughout, while the costæ are in the form of distinct striations, the course of which is indicated by the fine denticulations or echinulations of which they are composed, and the radial arrangement of which is generally much obscured: a condition comparable to that which obtains in *Lithactinia* rather than in *Fungia*.

Concerning this form (*Pavonia explanata*, Dana=*Podabacia crustacea*), Dana writes: "this species might well form a distinct genus. It looks much like an inverted *Halomitra*," a statement that is altered to a considerable extent by Milne-Edwards and Haime, who, in writing of the same species, say, "il se trouve indiqué dans l'ouvrage de M. Dana, qui le définit très-justement en l'appelant une Halomitre retournée et pédonculée." The genus *Podabacia* was certainly well instituted for this very distinct form.

The confusion between the genera *Podabacia* and *Halomitra* has arisen from the fact that there exist specimens which, while they have the characteristic *shape* of *Halomitra pileus*, yet possess the *structure* of *Podabacia crustacea*, as exemplified in the characters of the wall and costæ: specimens which are clearly referable to *Podabacia* (amended so as to include free as well as fixed forms).

From this it will be seen that we have no means of determining whether the *Mitra polonica* of Rumphius, which is usually regarded as being the *Halomitra pileus*, is really referable to *Halomitra* or *Podabacia*.

The *Halomitra pileus* of Dana is undoubtedly the *Madrepora pileus* of Pallas, whose description must certainly have been drawn up from a specimen of *Halomitra* and not of *Podabacia*. The description of Lamarck would apply equally well to either of the equiform specimens of *Halomitra* and *Podabacia*, and have included them both; while the redescription of Milne-Edwards and Haime was evidently drawn up from specimens of both of these types and is more applicable to the *Podabacia* than to the *Halomitra* form.

So that while, on the one hand, the specific term *pileus* must apply to the *Halomitra* (*Madrepora*) *pileus*, Pallas (=*Halomitra pileus*, Dana), it is desirable, on the other hand, to retain it also for the equiform *Podabacia*, which would, therefore, stand

as the *Podabacia pileus* (=*Fungia pileus*, pars), Lamarck (=*Halomitra pileus*, pars, Milne-Edwards and Haime).

Halomitra tiara, Verrill.

Halomitra tiara, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., vol. i. p. 53.

A small specimen was obtained which seems referable to this species, though differing in many characters from the description of the adult form. It is about 6 cm. in diameter, irregularly concave below and convex above, with a single large, central parent calicle, which becomes in the adult form indistinguishable from the younger ones which develop around it. The costæ are scarcely distinct at the centre but they become more distinct with age, and the narrow, elongated, pointed, costal spines become larger. The calicles are often very crowded and separated only by a few, short, narrow plates which are often undivided and appear quite broad in comparison with the pointed and rather narrow septal teeth. Around the axial cavity the septa are often broad, being almost or quite undivided, but with age they become more divided, prominent and pointed.

The species is very close to *Halomitra pileus* (Pallas), and may not be distinct from it.

Locality.—Mactan Island, Philippines.

Genus 3. *Podabacia*, Milne-Edwards and Haime.

Podabacia, Milne-Edwards and Haime, Cor., iii. p. 19.

The essential distinctions between *Podabacia* and *Halomitra* have been discussed under the latter genus. A not unimportant, additional point of difference between the two genera is to be found in the arrangement and dentation of the septa. In *Podabacia* the septa are evenly and closely placed, not markedly prominent around the fossa, while the teeth are small and do not give a markedly rough, irregular aspect to the corallum. In *Halomitra* the septa are markedly unequal, and very prominent around the fossa, while the teeth are very large, pointed and irregular, and give to the corallum a very rough and bristling aspect.

As now understood the genus is extended to include unattached as well as fixed forms. It includes the following three species :—

Podabacia crustacea (Pallas).
Podabacia pileus (Lamarck).
Podabacia robusta, n. sp.

The last is founded on a specimen in the collection.

Podabacia robusta, n. sp. (Pl. VI. figs. 5–5*b*).

Corallum subcircular, or irregularly elongated, convex above and concave below, strong and thick. The under surface extremely perforated and marked by radial,

irregularly bent and confluent, subdistinct costæ, which are thin at the marginal part of the corallum and thicker at the central portion, and are covered by closely crowded, small, blunt, extremely granulated papillæ, which are arranged more or less irregularly and often in small clusters. Calicles very distinct, apparently arranged around a central calicle, irregularly placed, sometimes crowded but generally separated by spaces of from 6 to 15 mm. Fossa small, subcircular or oval, very distinct owing to the close and even arrangement of the ends of the septa around it. Septa of three cycles, very distinctly radiate, continuous between adjoining calicles, very oblique at the inner part and much raised between the cells which thus become placed in wide depressions; the primaries and secondaries thick, with a rather sharp edge, which is irregularly divided and very granulated, with rather small teeth; the smaller septa very thin, crenulate and granulated; all the septa are evenly and closely placed, thus giving a neat and even appearance to the corallum. Columella slightly papillose, rudimentary.

A single specimen of this species was obtained. It is especially interesting as presenting a case of the development of a complete corallum from a fractured portion. The original piece with the costæ running in one direction forms the central portion of the specimen, the costæ of the lateral portions of the later growth being directed at right angles to those of the original piece from which they are developed.

The long diameter of the specimen is about 20 cm., and its thickness about 2 cm.

Locality.—Amboina.

Genus 4. *Cryptabacia*, Milne-Edwards and Haime.

Cryptabacia, Milne-Edwards and Haime, Cor., iii. p. 22.
„ Duncan, Rev. Madrep., p. 144.

The distinctness of this genus from *Polyphyllia* is extremely doubtful, since one species, *Polyphyllia substellata*, is known which is almost transitional.

Cryptabacia talpina (Lamarck).

Fungia talpina, Lamarck, Syst. Anim. sans Vert., p. 370.
Polyphyllia talpa, Dana, Zoophytes, p. 313, pl. xxi. fig. 5.
Cryptabacia talpina, Milne-Edwards and Haime, Cor., iii. p. 22.

The species seems to be very variable in the degree of distinctness of the median series and of the lateral calicles, in the prominence, size, and degree of dentation of the septa, and in the shape of the corallum. The ends may be pointed with the median series continued to the extremity, or more or less rounded with the median series suppressed. A slightly curved, long, broad, and pointed specimen was obtained. Tolerably good figures are given by Seba.[1]

Locality.—Amboina.

[1] Thes., iii. tab. cxi. No. 6, and tab. cxii. No. 31.

Genus 5. *Lithactinia*, Lesson.

Lithactinia, Lesson, Illustr. Zool. Paris, 1831.
„ Milne-Edwards and Haime, Cor., iii. p. 28.
„ Duncan, Rev. Madrep., p. 146.

This genus is undoubtedly very closely related to *Polyphyllia*. Very few forms of the two genera are known on which to base comparisons, and of these it is certain that injury to the colony during the growth of many of them has considerably interfered with and obscured the true character of the form. Owing to the very porous and fissured structure of the basal wall, and to the thinness of the corallum in these specimens, which are all unattached, such injury with consequent malformation is very liable to occur.

Two species are in the collection.

1. *Lithactinia pileiformis* (Dana).

Polyphyllia pileiformis, Dana, Zoophytes, p. 317, pl. xxi. fig. 4.

Two specimens were obtained. They are dish-shaped or basin-shaped, with one side much drawn out, so as to give in the larger specimen a length of 15 cm. and a breadth of 9 cm. Both specimens are peculiar in that they give the appearance of having been broken during life, while growth has continued around the edges of a rather large fractured piece, so that the added portion is continuous with the original part. This is borne out by the fact that the septa and costæ in the lateral pieces are not in the same line with those of the more central portion and do not radiate from a common centre, but are directed more or less at right angles to them. In both specimens also, and apparently confined to the original fractured piece, a very short, more or less subradiate, calicular trench is indicated, but not placed so as to be median to the whole corallum. The costæ in this species are very distinct, denticulate and rough, irregularly confluent, and separated by narrow, elongated fissures.

Locality.—Reefs, Fiji; brought alongside the ship by natives off Kandavu.

2. *Lithactinia galeriformis* (Dana).

Polyphyllia galeriformis, Dana, Zoophytes, p. 317, pl. xxi. fig. 3.

Two specimens were obtained. One, the larger, is conically cap-shaped, drawn out laterally so as to give a length of nearly 13 cm. and a breadth of nearly 9 cm. The second is smaller and broadly saucer-shaped, but irregular. They both present the same appearance, due to fracture, as in the *Lithactinia pileiformis;* but there is in no part any indication of a subradiate calicular arrangement.

The species is very close to the preceding, but differs markedly in its much thinner

and more delicate corallum, in its thinner, smaller, and shorter septa, and in the much less distinct costæ, which are finely denticulate, very confluent, and irregularly separated by short fissures.

Locality.—Reefs, Fiji; brought alongside the ship by natives off Kandavu.

Genus 6. *Herpetolitha*, Eschscholtz.

Herpolitha, Eschscholtz, Isis, p. 746, 1825.
Herpetolitha, Milne-Edwards and Haime, Cor., iii. p. 23.
Herpolitha, Duncan, Rev. Madrep., p. 145.

The structure of the corallum in this genus has been investigated in detail by Professor Duncan.[1]

Herpetolitha crassa, Dana.

Herpetolithus crassus, Dana, Zoophytes, p. 310, pl. xx. fig. 5.

A single very large specimen of this species was obtained. Though close to the *Herpetolitha limax*, it seems to be fairly distinct. The description and figure given by Dana are very good.

Locality.—Banda.

Genus 7. *Sandalolitha*, Quelch.

Sandalolitha, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 294.

Corallum compound, flattened, free, much elongated and very thin. Wall sparsely perforated and extremely reduced; costæ distinct, fine, subequal, closely granulated or very finely and bluntly echinulate, curving towards the short axis. Calicles few, in the long diameter of the corallum; parent calicle very large, occupying the centre, forming almost the entire corallum, with very numerous septa, there being about seven complete cycles, a much larger number of cycles being developed in the long axis of the corallum; smaller calicles very few, distinctly radiate, developing in the course of and interrupting the larger septa in the long axis of the parent calicle. The septa are crowded and very long, curving towards the short axis, and of more or less equal vertical extent, very low, giving an even laminate appearance to the corallum. Synapticulæ well developed and forming strong connections at the basal parts of the septa. Columella rudimentary and trabecular.

This genus is related to *Zoopilus*, *Halomitra* and *Podabacia*. With *Podabacia* it closely agrees in the nature of the costæ, though the rays are more continuous owing

[1] *Journ. Linn. Soc. Lond.* (Zool.), vol. xvii. p. 152.

to the much less porous condition of the wall. With *Halomitra* it agrees in the nature of the septal teeth, and in the size and distinctness of the parent calicle; but it is easily distinguished by the costal rays, which are fine and do not form strong and thick lamellæ with coarse spines, by its manner of growth with high septal cycles on the long axis, by the development of few smaller calicles in the longitudinal axis, and by the reduced wall. From *Zoopilus*, to which it seems to be more closely related, it is distinguished by the possession of a distinct, large, central calicle, by the development of fresh calicles in the course of the long axis close to the parent calicle and interrupting the larger as well as the smaller septa, and by the costæ, which are fine and not prominent nor divided into strong clustered teeth. In the specimen of *Zoopilus* figured by Dana, there is a distinct central depression, but this is stated by him to be an "accidental distortion and not the position of a medial orireme." In the absence of such a central calicle, the nature of the long, large, radiating, uninterrupted septa remains incomprehensible.

Sandalolitha dentata, Quelch (Pl. VII. figs. 1–1*d*).

Sandalolitha dentata, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 295.

Corallum almost flat, irregularly sandal-shaped, fragile, translucent, being about 6 mm. thick, except immediately around the mouth of the central calicle where the septa are somewhat elevated and thickened. The parent calicle attains a large size, nearly 15 cm. in length, before the smaller calicles are developed. Wall very thin, pierced with numerous small pores; costæ slightly unequal, with very small, granulated, blunt spines, distinct, curving in radiating lines towards the short axis of the corallum except at the centre, where the costal spines become crowded over a thickened circular space that seems to have been a former base of attachment. Septa of the central calicle of seven complete cycles, but incomplete orders are developed at the extremities of the long axis of as many as sixteen cycles; those of the first three cycles subequal, slightly thickened and prominent at the centre; and, with the exception of the very small ones, all the septa are nearly equally raised over the general surface, cut into strong, long, and narrow teeth, very granulated, especially at the apex of the teeth; the teeth are obtuse or pointed, the extremity being subdivided into pointed spinules. The septa of the higher orders unite, one on each side, with one of a lower order at that part of it from which they originate. Columella rudimentary.

Only a single specimen of this species was obtained. It is rather bent to one side, about 15 cm. long. and 6·5 cm. wide, narrowing slightly towards the extremities and rounding off suddenly. At the centre, where the septa are raised, it is about 15 mm. thick, and, except at this thickened portion, the corallum is quite translucent. The under portion is marked with many concentric, curved undulations, elongated in the direction of the long axis, following the growth of the corallum. In one direction of its

length a primary septum corresponds exactly with its median axis, but on the other the septum has curved to one side at a distance of about 15 mm. from the median axis. Besides the large parent calicle, there are five other calicles which are more or less distinctly developed. Of these the most perfect is situated close to the central one, and interrupts the course of the primary septum in the long axis. The other four are incompletely developed, and are situated between the smaller septa, where two of these are attached to a septum of a lower order; a widening of the interseptal space takes place at this point, and lateral thickenings, with incurving of the adjoining larger septa, indicate the formation of new septa for the developing calicle, which becomes complete when final division of the large septa takes place at the point of incurving.

The long, fragile, nearly flat and thin corallum; the closely packed, even, rather thin and long septa; the large median calicle, with smaller calicles almost unperceived at a first glance, give a striking habit to this form and easily separate it from all others.

Locality.—Tahiti.

Section MADREPORARIA PERFORATA.

Family EUPSAMMIDÆ.

Genus 1. *Rhodopsammia*, Semper.

Rhodopsammia, Semper, Zeitschr. f. wiss. Zool., Leipzig, 1872, p. 257.
,, Duncan, Rev. Madrep., p. 182.

A single species of this genus was obtained. The anatomy of this form has been investigated in detail by Mr G. Herbert Fowler.[1]

Rhodopsammia parallela, Semper.

Rhodopsammia parallela, Semper, Zeitschr. f. wiss. Zool., Leipzig, 1872, p. 258, pl. xix. figs. 1–4.

Several specimens of this species in the collection show interesting differences from those described by Semper. In the largest calicles five complete cycles are present, while at the extremities of the long diameter orders of a sixth cycle are to be found. The primary and secondary septa are scarcely thicker than the smaller ones, much less so than is shown in Semper's figure (fig. 4). The separate calicles are much less suddenly

[1] *Quart. Journ. Micr. Sci.*, new ser., October 1885.

pointed towards the base, being more elongated; and in the smaller calicles the shape of the cup is regularly oval.

From these points it will be seen how extremely close the species is to the *Rhodopsammia ovalis*, from which it appears to differ in having the larger septa strongly granulated.

Localities.—Samboangan, Philippines, 30 fathoms; Arafura Sea, 49 fathoms.

Genus 2. *Dendrophyllia*, Blainville.

Dendrophyllia, Blainville, Dict. d. Sci. Nat., lx. p. 319.
Dendrophyllia et *Cœnopsammia*, Milne-Edwards and Haime, Cor., iii. pp. 112, 125.

Verrill has already pointed out that the genus *Cœnopsammia* cannot be kept distinct from *Dendrophyllia*.[1] Professor Duncan has made it a subgenus,[2] but it seems to me that it should be sunk altogether in *Dendrophyllia*.

Four species were obtained.

1. *Dendrophyllia axifuga*, Milne-Edwards and Haime.

Dendrophyllia axifuga, Milne-Edwards and Haime, Cor., iii. p. 119.

A small but well-preserved fragment of this species was obtained. Its very characteristic mode of growth easily serves to distinguish it from all other species of the genus.

Locality.—Wednesday Island, Torres Strait, 8 fathoms.

2. *Dendrophyllia conferta*, n. sp. (Pl. VII. figs. 2–2*b*).

Corallum consisting of an elongated main stem which is essentially the parent calicle, from which, on all sides, numerous, closely-packed, long calicles arise as branches to form a nearly flat-topped clump. The branch-like calicles again bear corresponding calicles like branchlets, and, at the upper parts especially, they are crowded with short buds which are scattered irregularly around them. The calicles never remain short, but elongate to form branches and branchlets. Owing to the close crowding of the branch-like calicles, many of them coalesce laterally throughout a greater or less extent of their length. The older calicles subcircular, from 5 to 8 mm. deep and from 10 to 12 mm. wide (the younger ones much less), of nearly the same diameter throughout all their length, but turbinated at the base, the point of junction with the branches being rather narrow. The small developing calicles markedly turbinate. Costæ very distinct, unequal, generally alternately large and small, denticulate. Septa included, thin, almost entire, finely and pointedly granulous; four cycles complete in the larger cups, occasionally

[1] Dana, Corals and Coral Islands, p. 336.

[2] Rev. Madrep., p. 178.

rudiments of a fifth occur; septa of the first and second cycles broad, prominent, and subequal, those of the fourth narrow, curving, and generally meeting those of the third at some distance from the abundant and spongy columella.

This species recalls *Dendrophyllia surcularis*, Verrill, in many of its characters, but is easily distinguishable from it. The clump in the collection is about 12 cm. high, and a little wider than its height. When viewed from above the specimen has much of the appearance of a colony of *Astroites calycularis*, owing to the extremely packed arrangement of the calicles, which rise to the same level and are often united, though never so much so as to give rise to a simple wall.

Locality.—Australia.

3. *Dendrophyllia diaphana*, Dana.

Dendrophyllia diaphana, Dana, Zoophytes, p. 389, pl. xxx. fig. 3.

A very small colony of this rather delicate species was obtained.

Locality.—Kandavu, Fiji.

4. *Dendrophyllia equiserialis* (Milne-Edwards and Haime).

Cœnopsammia equiserialis, Milne-Edwards and Haime, Cor., iii. p. 129.

A small and rather delicate specimen occurs in the collection. It differs from typical specimens of the species in that the septa of the third and fourth cycle are extremely narrow.

Locality.—Samboangan, Philippines.

Family Madreporidæ.

Genus *Madrepora*, Linnæus.

Madrepora, Linnæus, Syst. Nat., ed. x. p. 793.
„ Dana, Zoophytes, p. 431.
„ Duncan, Rev. Madrep., p. 183.

An extremely interesting new species (*Madrepora mirabilis*) in the collection presents a combination of characters hitherto unknown in the genus. While the greater number of apical calicles are of the ordinary type with twelve septa, others possess three cycles of septa, and these in a few calicles are all well developed (Pl. X. fig. 5*a*). This is certainly a most striking deviation from the normal condition in the genus; and if it had been common to all the apical calicles in the specimen of *Madrepora mirabilis*, it might have been regarded as a sufficient characteristic for generic separation. Consider-

ing the mode of its occurrence, however, it can only be looked upon as a remarkable variation in the characters of *Madrepora*.

Another curious feature in this same species is the condition of two of the septa in a large number of the lateral calicles. Two opposite septa are not only enlarged, as is often the case in many species of *Madrepora*, but become distinctly exsert and sometimes considerably so. In other calicles no trace of this exists.

In many species of the genus more or less marked differences exist between the terminal and lateral calicles, but, apart from the suggestive fact that in many species no such differences exist, it must be remarked that the terminal and lateral calicles are subject to considerable variation among themselves; so that it does not seem possible to regard the terminal polyps as presenting a case of dimorphism. Verrill remarks that dimorphism is unknown among the *Madreporaria* unless the terminal polyps of *Madrepora* be regarded as offering such a case.[1]

Two important papers, relating, among other things, to growth and budding in *Madrepora*, have recently been published, one by Mr. S. O. Ridley of the British Museum of Natural History,[2] and the other by Professor Duncan.[3] It seems to be clearly established that budding takes place from the *walls* of the calicles, and not from their *margin*. No case of marginal budding or fission has come under my observation.

Fifty species of the genus are in the collection. Of these it is probable that some will have to be made synonyms of others, for though, from the want of series of specimens, it has been impossible in many cases to determine with certainty their specific identity or difference, it is evident that many of the forms are very closely allied.

1. *Madrepora securis*, Dana.

Madrepora securis, Dana, Zoophytes, p. 486, pl. xliii. fig. 2.

Three large fragments of this species were obtained. One, from Banda, is simply an erect plate, grown obliquely on one side, the upper margin of which has lost its typical quadrate shape and become somewhat trenchant. The calicles, though tubiform, have the lower edge much stronger than the upper, and often become rather shortly cochleariform, as in *Madrepora labrosa*.

Localities.—Banda; Samboangan, Philippines.

2. *Madrepora cuneata*, Dana.

Madrepora cuneata, Dana, Zoophytes, p. 487.

A single small specimen and a fragment of this species were obtained. The thick lobes which arise from the spreading, incrusting, recurved and contorted plates, are very

[1] *Proc. Amer. Assoc. Adv. Sci.*, 1867, p. 150.
[2] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xiii. p. 284.
[3] *Ann. and Mag. Nat. Hist.*, ser. 5, vol. xiv. p. 188.

short and irregular, and indicate the characteristic shape of the species as described by Dana.

Locality.—Reefs, Fiji.

3. *Madrepora palmata*, Lamarck.

Madrepora palmata, Lamarck, Hist. Anim. sans Vert., ii. p. 278, 1816.

As pointed out by Pourtalès [1] from actual observation on the Florida reefs of a large number of specimens, of all sizes and ages, *Madrepora flabellum*, Lamarck, *Madrepora alces*, Dana, *Madrepora cornuta*, Duchassaing and Michelotti, and *Madrepora thomasiana*, Duchassaing and Michelotti, are but varieties of this species, and "pass from one to the other by gradations among which it is impossible to draw the limit." A series of specimens in the collection fully bears out this conclusion.

Locality.—St. Thomas, West Indies.

4. *Madrepora prolifera*, Lamarck.

Madrepora prolifera, Lamarck, Hist. Anim. sans Vert., ii. p. 281, 1816.

A single specimen of this species was obtained. It is very close to *Madrepora cervicornis*, and bears out the remark of Pourtalès as to the doubtfulness of their specific difference.[2]

The figure in the Report on the Florida Reefs, pl. xix., can scarcely be considered typical of the species, since it presents a form with the thick, short calicles which are more generally characteristic of *Madrepora cervicornis*. The calicles in this species are generally very long, tubular, and rather slender, especially towards the distal parts.

Madrepora ethica, Duchassaing and Michelotti, does not seem to be separable from this species.

Locality.—St. Thomas, West Indies.

5. *Madrepora cervicornis*, Lamarck.

Madrepora cervicornis, Lamarck, Hist. Anim. sans Vert., ii. p. 281, 1816.

A fine example of this species was obtained. The form, size, length, and striation of the calicles are very variable in the species; and the variable thickness of the corallum in a series of specimens is a marked feature.

A very good figure of the species is given in the Report on the Florida Reefs, pl. xviii.

Locality.—St. Thomas, West Indies.

[1] *Illus. Cat. Mus. Comp. Zoöl.*, No. iv. p. 83.

[2] *Illus. Cat. Mus. Comp. Zoöl.*, No. iv. p. 84.

6. *Madrepora manni*, n. sp. (Pl. IX. figs. 1–1*a*).

Corallum arborescent and loosely branched, somewhat prostrate; the branches round, much elongated, about 2 cm. thick or more, gradually diminishing, and with few branchlets; branchlets simple, very elongated, often as much as 9 cm. long, slightly tapering, about 15 mm. thick at the base and 6 mm. at the apex, ascending, arcuate, irregularly bent and generally springing from the upper surface of the oblique branches. Apical calicles not large, from 2 to 3 mm. wide, not prominent, with rather thick and scarcely porous edges; star somewhat distinct, with six or twelve unequal, narrow septa. Lateral calicles extremely and broadly labellate, at right angles to the branch, very crowded; fragile, so that the lips are easily broken away, leaving the stronger basal part; more abundant, more prominent and stronger on the upper surface, becoming short and immersed on the basal part; the lip seldom flattened, generally curved, thin, and about 2·5 mm. long, often as broad, though generally narrower and sometimes very small. A section of the cell across the base of the lip shows a very narrow aperture, about 0·5 to 1 mm. wide, the immersed cells being of the same width; star inconspicuous. The cœnenchyma close and dense; the surface finely granulated and echinulated, and the calicles strongly striated.

This form in its strongly marked characters differs from all other known species of the genus. It is named in honour of Dr. de Mann, late of the Leyden Museum, who first recognised its specific distinctness, but did not describe it. Its representative in the collection consists of a branched portion evidently broken from a large specimen.

Locality.—Samboangan, Philippines.

7. *Madrepora nobilis*, Dana.

Madrepora nobilis et secunda, Dana, Zoophytes, p. 481, pl. xl. figs. 3, 4.

Only a much branched portion of a specimen was obtained. It agrees closely with the form described by Dana as *Madrepora secunda;* but Verrill has stated that intermediate forms between this and *Madrepora nobilis*, which have been examined by him, show that they are one and the same species. In accordance with this observation of Verrill's I have united the two species, though to judge by the description and figures given by Dana, they seem clearly distinct.

Locality.—Kandavu, Fiji.

8. *Madrepora canalis*, n. sp. (Pl. IX. figs. 2–2*b*).

Corallum arborescent, large, erect, loosely branched; branches few, three or four often springing from the main stem at the same level, terete, about 2 cm. thick or more,

gradually diminishing to a blunt end, which is often crowned by two or three branchlets; angle of branching acute; branchlets narrowly subconical. Terminal calicles rather large, from 3 to 4 mm. wide, not prominent, with much thickened edges; star very distinct, with six large and six small septa. Lateral calicles large, crowded, erect, broadly dimidiate or spout-shaped, presenting a more or less crescentic outer margin, which is very thick and porous and very much broader than the basal part of the cup; star very distinct, of twelve well-developed septa, two of which are very large; length of calicles about 3 mm., often less, width at the margin as much; many calicles are quite small and are interspersed among the prominent ones, and on the under surface of the branches all the cells become smaller and shorter. Cœnenchyma reticulated and more or less porous; surface reticulate and echinulate, becoming striated on the cups.

This species is readily recognised by the characters of its calicles, which give a very striking appearance to the corallum. As the result of the narrowing of the basal part of the cups, where they join the branches, the aperture of the cell into the branch is very small. Only a single large specimen was obtained. Its closest ally seems to be *Madrepora nobilis*.

Locality.—Samboangan, Philippines.

9. *Madrepora robusta*, Dana.

Madrepora robusta, Dana, Zoophytes, p. 475, pl. xxxix. fig. 3.

Only two fragments of this species were obtained. The greater number of the branchlets taper much more gradually to a point than is shown in Dana's figures.

Localities.—Kandavu and other reefs, Fiji.

10. *Madrepora danæ*, Verrill.

Madrepora deformis, Dana (non Michelin), Zoophytes, p. 484, pl. xliii. fig. 1.
„ *danæ*, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., vol. i. p. 41.

Two very fine specimens of this species were obtained. The description given by Dana requires amending in several particulars, for evidently it was founded on a rather small specimen. The chief branches are often simple, especially the shorter ones, but on attaining a height of about 10 cm. or more they become very proliferous at the apex, and often as many as nine small branchlets spring therefrom, while the basal portion is generally destitute of such branchlets, and is only crowded with the proliferous calicles which are found over the entire corallum, and which give it a very rough appearance. Although many of the thick branches are obtuse at the apex, yet very many taper almost to a point, as is shown in many parts of Dana's own figure; and the small branchlets are generally rapidly tapering. The lateral coalescence below of many of the large branches,

their irregularly bent and divergent forms, and the apical bunch of proliferous branchlets on the large specimens, give a peculiar appearance to the corallum. It closely resembles *Madrepora abrotanoides*, and may ultimately prove to be only a well-marked variety of that species.

Locality.—Tahiti.

11. *Madrepora austera*, Dana.

Madrepora austera, Dana, Zoophytes, p. 478.

The specimen of this species consists of a broad, low clump, which has evidently grown under peculiar conditions. The base has formed on one side a solid massive piece, while on the other sides it has grown incrusting over a mass of dead coral. The branches are short, thick, and very proliferous, and many of them have been broken during growth. The surface is very rough, reticulated and echinulate. The lateral calicles are harshly striated, frequently dimidiate, or tubo-nariform, with a very elongated aperture, very unequal, often proliferous, and becoming immersed on the basal parts of the branches and on the incrusting base. On the upper parts of the branches and branchlets immersed cells do not occur as numerously as in *Madrepora abrotanoides*, but they are often present in large numbers on the under side.

Locality.—Mactan Island, Philippines.

12. *Madrepora scabrosa*, n. sp. (Pl. X. figs. 2–2*e*).

Corallum fruticose, much branched, closely crowded, and proliferous, attaining a very large size; the branches subterete, thick at the base, often as much so as 3 cm., ascending, arcuate or irregularly bent, but not divaricate; branchlets subattenuate, often much elongated, but generally short, especially at the exterior basal part, where they are thick, irregular, and almost spike-shaped. Apical calicles about 3 mm. wide, prominent, with thick, somewhat porous edges, and a distinct star of twelve unequal, narrow septa, which meet deep down in the cell. Lateral calicles rather appressed, very unequal, often 5 mm. long; scarcely crowded above, where they are tubiform and long, quickly becoming tubo-nariform and rostrato-nariform; crowded below, short, rostrato-nariform, and round-nariform, rarely proliferous, and almost or completely immersed on the basal parts; many very short and small cells occur between the prominent ones, opening sideways or downwards; and numerous, long, tubiform cells on the upper branches and branchlets become proliferous with short calicles along their under side, remaining bare on their upper side during a long period of growth; the aperture of the cell is large, round below and oblong above, with the lower side very rough and generally finely spinulose; star

distinct, of twelve narrow, unequal septa, which meet low down in the cell. Cœnenchyma very dense; surface closely and strongly echinulate throughout, but not striated even on the cups.

A single large specimen of this well-marked species was obtained. Its closest ally seems to be *Madrepora divaricata*, Dana, from which, however, it is easily distinguished.

Locality.—Levuka, Fiji.

13. *Madrepora plantaginea*, Lamarck.

Madrepora plantaginea, Lamarck, Hist. Anim. sans Vert., ii. p. 279, 1816.
„ „ Milne-Edwards and Haime, Cor., iii. p. 149.

A single specimen of this species was obtained. The apical cups are about 3 mm. or more in diameter. In the type specimens of Lamarck, one of which has been redescribed by Milne-Edwards and Haime, the apical cups of many of the larger branches are very abnormally thickened, varying from 5 to 8 mm. in width, and are very short, with a broad rosette of small lateral calicles around them, evidently brought about by the stoppage of vertical growth and the increase horizontally under unfavourable conditions.

Madrepora acervata, Dana, referred by Verrill to this species, seems to be distinct from it.

Locality.—Tahiti.

14. *Madrepora cerealis*, Dana.

Madrepora cerealis, Dana, Zoophytes, p. 460, pl. xxxv. fig. 2.

A fine specimen of this species was obtained. It has grown in an oblique manner, forming a spreading cespitose clump, springing from the end of a long, nearly horizontal stump. The lateral calicles are often 4 mm. long, the proliferous ones being even more, and are tubo-nariform, rostrato-nariform, or even dimidiate; their exterior is finely and closely striated.

Locality.—Amboina.

15. *Madrepora retusa*, Dana.

Madrepora retusa, Dana, Zoophytes, p. 462.

A small specimen of this species was obtained. It consists of two erect branches bearing a few branchlets above. The immersed calicles interspersed among the prominent ones are very small.

Locality.—Tahiti.

16. *Madrepora nasuta*, Dana.

Madrepora nasuta, Dana, Zoophytes, p. 453, pl. xxxiv. fig. 2.

Two very interesting specimens of this species were collected. In one, the calicles are strikingly prominent above, never appressed, quickly obsolescent at a short distance from the apex, and almost entirely immersed below so that the aperture is directed more outward than upward from the branchlets; in the other, the calicles are less prominent, rather appressed, and obsolescent at a greater distance from the apex than in the former specimen. In both, many of the branchlets are frequently divided and often proliferous above.

Locality.—Tahiti.

17. *Madrepora effusa*, Dana.

Madrepora effusa, Dana, Zoophytes, p. 455.

The specimen of this species is a broad, cespitose, and one-sided clump, which has spread over dead coral, its growth having evidently taken place under unfavourable conditions. As a result of this disturbance the basal disk is very slightly developed, and the spreading branches are rather loosely coalescent. The lateral calicles are prominent, very irregular in size and shape, being either long or short, compressed-nariform, tubo-nariform, or dimidiate.

Locality.—Amboina.

18. *Madrepora paxilligera*, Dana.

Madrepora paxilligera, Dana, Zoophytes, p. 452, pl. xxxiv. fig. 1.

A large specimen of this species was obtained. It consists of numerous, closely-crowded branchlets arising from a large, solid base, which is nearly flattened below and attached by a small pedicel, and from which numerous, closely-placed, very flattened, coalescent, divided branches spread horizontally. The vertical branchlets often arise two or three together, rarely more, and are seldom divided at the apex. The lateral calicles are rather large, very crowded, dimidiate or tubo-nariform, a little prominent and somewhat appressed; not immersed below, except at the extreme basal parts of the branchlets, but becoming appressed, rounded, somewhat swollen, with the aperture opening upwards and distinctly seen from above.

The species seems to be very close to *Madrepora nasuta*, and may ultimately have to be united with it.

Locality.—Tahiti.

19. *Madrepora seriata* (Ehrenberg).

Heteropora seriata, Ehrenberg, Cor. roth. Meer., p. 113.

A single specimen of this species was obtained. It forms a broad, spreading tuft, incrusting a mass of dead coral. The lateral calicles are wide, open, generally tubular or subtubular, sometimes cochleariform, with a much thickened lower portion; they are closely placed, and arranged in well-marked rows up the branches and branchlets, especially towards the apical parts; many immersed calicles occur between the prominent ones, and towards the basal parts all the cups are shortly verruciform and much thickened, becoming immersed and often obsolescent. The central branches are somewhat compressed and angular, nearly simple or marked with many large calicles giving origin to branchlets; the exterior stems are shortly and much branched.

Madrepora pyramidalis, Klunzinger, seems to be extremely close to this species.

Locality.—Kandavu, Fiji.

20. *Madrepora hebes*, Dana.

Madrepora hebes, Dana, Zoophytes, p. 468, pl. xxxv. fig. 5.

Three specimens of this species were obtained. One small specimen presents many points of divergence from the common form; the lateral calicles are larger, sometimes as much as 3 mm. wide, and more gaping; the branches are thicker and shorter, and crowned above by a stouter apical calicle. This form seems to be that described and figured by Quoy and Gaimard as *Madrepora pocillifera*.[1]

Localities.—Kandavu and other reefs, Fiji.

21. *Madrepora pocillifera*, Lamarck.

Madrepora pocillifera, Lamarck, Hist. Anim. sans Vert., ii. p. 280, 1816.
„ „ Milne-Edwards and Haime, Cor., iii. p. 141.

The branches and branchlets of the specimens vary considerably in length and thickness. In some they are short and uniformly thick almost to the tips, where they become slightly acuminate; in others they are elongated, and lessen gradually in size, becoming much more pointed at the ends. The apical calicles consequently are large and thick, or rather delicate and small.

The tufted and thick growth of *Madrepora pallida*, Klunzinger, and its thick, open, tubular, lateral calicles separate it easily from this species in which the calicles are rather thin and fragile, cochleariform or short-labellate.

The lower portion of the corallum with its rough, uneven surface and rather large, immersed cells bears some slight superficial resemblance to a *Pocillopora*.

Localities.—Reefs, Fiji; Api, New Hebrides; Tongatabu.

[1] Voy. de l'Astrolabe (Zool.), vol. iv. p. 236, pl. xix. fig. 5.

22. *Madrepora laxa*, Lamarck.

Madrepora laxa, Lamarck, Hist. Anim. sans Vert., ii. p. 280, 1816.
„ „ Milne-Edwards and Haime, Cor., iii. p. 146.

A portion only of a specimen was obtained. The species is very close to *Madrepora pocillifera*, but seems to be sufficiently distinguished by the nature of the calicles, which are tubo-labellate, much thicker and stronger, especially on the under side of the cup, not oblique or fragile, but becoming verruciform, especially towards the basal parts of the branchlets. The branches are often short and thick, with many proliferous branchlets crowned by thick and broad apical cups. The surface is shortly striate, dense and echinulate.

Locality.—Reefs, Fiji.

23. *Madrepora aspera*, Dana.

Madrepora aspera, Dana, Zoophytes, p. 468, pl. xxxviii. fig. 1.

The specimens of this species agree closely in essential features with the description given by Dana, whose specimen was a fragment 3 inches in height. Those in the collection are large and much branched specimens, and show very clearly that though the apical parts are porous in texture, the basal portions are dense and firm. The lateral calicles are very unequal and rather crowded, many very small narrow labellate ones being placed between the larger, which are broadly labellate; the aperture of the cell where it joins the branch is always small. Dana characterises the cells as being quite large, but a reference to his figure of a branch, natural size, will show that the term must be applied to the broad lip and not to the aperture of the cell where it joins the branch. His measurement for the width of the immersed cells below is half a line, but at the basal parts in large specimens it is much smaller, and in many parts the cells are seen to be quite minute openings over the surface of the corallum.

The fragile lips of the lateral calicles, which are very prominent above and erect or divaricate, are very easily destroyed, the narrow cells becoming more or less obsolescent; while the stronger basal parts of the larger calicles give a rough and ragged appearance to the branches.

The species is very close both to *Madrepora pocillifera* and to *Madrepora laxa*. In *Madrepora pocillifera* the calicles are quite oblique, more open and cochleariform, larger and more crowded; in *Madrepora laxa* the differences seem to be less marked, but the calicles are shorter, not fragile, tubo-labellate with a thickened lip which is not flattened, but almost verruciform in many parts.

Locality.—Mactan Island, Philippines.

24. *Madrepora millepora* (Ehrenberg.)

Heteropora millepora, Ehrenberg, Cor. roth. Meer., p. 109.
Madrepora millepora, Dana, Zoophytes, p. 446, pl. xxxiii. fig. 2.

Only a single specimen of this species was obtained. It has grown with an incrusting base over a mass of dead coral, and is made up of a mass of closely crowded, young colonies in different stages of growth; some with simple stems, others forming small and much branched clumps; while in other places, on the incrusting base, there are numerous, large, apical calicles, from which new branches originate. The calicles on the branches and branchlets are about 1 mm. broad, but they are usually much smaller on the base.

Locality.—Api, New Hebrides.

25. *Madrepora minima*, n. sp. (Pl. IX. figs. 4–4*a*).

Corallum arborescent, spreading-ramose, very slender, often slightly compressed and incrusting dead coral where it comes in contact with it; branches rather short, terete, bluntly pointed, from about 4 to 6 mm. thick, with few, short, scarcely smaller branchlets; not infrequently the branches on meeting a foreign body spread over it and become broad and thickened. Apical calicles moderately large, nearly 3 mm. in diameter, scarcely prominent with six large and six small well-developed septa. Lateral calicles very small, unequal, and crowded, from about 0·5 to 0·75 mm. in diameter, scarcely prominent, quite immersed below, fragile, strongly striated, round-nariform or sublabellate; six septa distinct, with two larger than the others, the second cycle rudimentary. The surface is finely echinulate, of a close texture below, becoming somewhat porous above.

This species is close to *Madrepora exigua*, Dana, but is easily distinguished from it. Two small specimens about 9 cm. high were obtained, and many of the branches have a peculiar appearance, spreading over and incrusting pieces of dead coral.

Locality.—Api, New Hebrides.

26. *Madrepora tenuis*, Dana.

Madrepora tenuis, Dana, Zoophytes, p. 451.

Numerous specimens of this species were obtained. The branchlets are very numerous and slender, but are often as much as 5 or 6 mm. thick at their base.

Locality.—Samboangan, Philippines.

27. *Madrepora rosacea*, Esper.

Madrepora rosacea, Esper, Pflanz., i., Madrep. pl. xv.
„ „ Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1878, p. 530.

Three specimens were obtained, of which one forms a cespitose clump with close branches, subdividing into numerous branchlets above. The calicles are narrow but very

long, appressed, tubiform, tubo-nariform, or shortly labellate, very strongly striated; on the basal parts they become shortly verruciform and immersed. Many short or immersed cells occur between the prominent ones. The branches may be short or much elongated, and give a corresponding appearance to the clump. The surface is striate and finely echinulate.

Localities.—Ternate; Samboangan, Philippines.

28. *Madrepora pustulosa*, Milne-Edwards and Haime.

Madrepora pustulosa, Milne-Edwards and Haime, Cor., iii. p. 144.

A small specimen was obtained which differs from typical specimens of the species in a few particulars, but not sufficiently to separate it.

The branches are rather numerous, not notably thick below, and they decrease gradually in size to the point of origin of the branchlets. Many small, irregular calicles are interspersed among the long, tubular ones above; and below, on the basal parts, the calicles become short, swollen and uneven, often obsolescent, especially on one side of the corallum, which has evidently been the under side.

A new species from the Red Sea, quite different from this, has been described by Klunzinger under this name; and as Milne-Edwards and Haime claim priority for the term *pustulosa*, I propose to associate the name of the distinguished author with the species—*Madrepora klunzingeri* = *Madrepora pustulosa*, Klunzinger.[1]

Locality.—Levuka, Fiji.

29. *Madrepora gracilis*, Dana.

Madrepora gracilis, Dana, Zoophytes, p. 482, pl. xli. fig. 3.

Two fine specimens and a few fragments were obtained. The lateral calicles are very obliquely placed, and on the branchlets are often much elongated (3 mm.) and tubo-nariform, while on the basal parts they become quite short.

Locality.—Amboina.

30. *Madrepora virgata*, Dana.

Madrepora virgata, Dana, Zoophytes, p. 471, pl. xxxix. fig. 1.

Small specimens were obtained, many of the branches of which are rather thinner than in those described by Dana, and are more frequently divided.

Locality.—Tahiti.

[1] Cor. roth. Meer., ii. p. 8, pl. i. fig. 1.

31. *Madrepora ramiculosa*, Dana.

Madrepora ramiculosa, Dana, Zoophytes, p. 463, pl. xxxv. fig. 4.

A single small specimen was collected. It forms a dense, closely-branched, convex clump, about 6 cm. high. It is evidently only a young specimen.

Locality.—Reefs, Fiji.

32. *Madrepora confraga*, n. sp. (Pl. IX. fig. 6–6*a*).

Corallum spreading, prostrate, flattened, or vasiform (?), consisting of somewhat vertically compressed, very uneven, seldom coalescent branches, which are much divided into numerous, widely-placed clusters of very irregular and rough-looking, divided branchlets. The branches are about 15 mm. thick or more, angular, rapidly diminishing in size as they divide; the branchlets on the upper part of the corallum are short and rather thick, about 7 mm. wide at their base, rapidly lessening in size; on the under side of the corallum the branchlets are less divided and more spike-like. The apical calicles are rather prominent and small, from about 2 to 2·5 mm. wide, with rather thick edges and a distinct star of six large and six very small septa. Lateral calicles short, about the same size as the terminal ones, not at all crowded, generally much swollen and subglobose, with an aperture of about 1 mm., opening upwards; on the basal parts of the branches and on the under surface the cells become immersed and more scattered; star very distinct, of six large and six very small septa. Cœnenchyma very dense throughout; surface slightly reticulate, and very irregularly and echinulately striated.

A single large piece of a specimen of this species was obtained, and evidently from the nature of the branches spreading horizontally in the same plane it must have grown in a prostrate manner, flattened or vasiform.

The species bears a close resemblance in many of its characters to *Madrepora ramiculosa*, Dana, but its mode of growth, the nature of its calicles, and the nature of the cœnenchyma at once distinguish it.

Locality.—Kandavu, Fiji, brought up in the trammels at the anchorage.

33. *Madrepora mirabilis*, n. sp. (Pl. X. fig. 5–5*b*).

Corallum prostrate; the branches originating laterally from a thick, compressed, elongated stem, and somewhat coalescent with one another. The stem may be 4 cm. wide, or more, tapering gradually; often spreading over masses of dead coral, but not forming a thick basal disk. The under part of the prostrate stem and branches almost entirely destitute of branchlets, but on the upper part and on the sides the branches are very numerous and closely placed. They are short, spike-shaped, and simple, from about 6 to 7 mm. thick at the base, and rarely divided above. The apical calicles are moderately large,

generally about 2·5 mm. wide, sometimes more, very short and thick, with very porous edges, and with a very distinct star of twelve septa. In many apical cups small or rudimentary septa of athird cycle are present, and in a few cups of larger size they are large and well developed. The lateral calicles are very unequal and variable, generally about 1·5 mm. wide, immersed and rather widely placed on the under surface and over a large part of the upper surface; often slightly prominent on one side, forming very short, open, round-nariform cups, while not infrequently they are crowded, and, by the thickening and upgrowth of the under side, shortly verruciform. The stars are very distinct, of twelve unequal septa; and in those calicles which are not verruciform, two opposite septa of the first cycle become decidedly and strongly exsert. The cœnenchyma is porous in the younger parts, becoming closely reticulate and dense below; the surface very roughly and closely echinulate, and strongly striated on the under sides of the calicles.

A single specimen of this species was obtained. It has grown prostrate in one direction to a length of about 26 cm., branching laterally and so closely that the branches are broadly coalescent at the point of origin. Many parts of it are dead, and more or less incrusted by fresh growth. Its peculiar characters separate it widely from all other known species of the genus.

Locality.—Banda.

34. *Madrepora aculeus*, Dana.

Madrepora aculeus, Dana, Zoophytes, p. 450, pl. xxxii. fig. 6.

A small, dead, and somewhat incrusted fragment of a corallum has been doubtfully referred to this species. It differs from Dana's figure chiefly in the nature of the branchlets, which are here shorter and furcate, sometimes divided into three or four, with a thick base from about 7 to 9 mm. in diameter. In other essential characters it agrees with the species.

Locality.—Samboangan, Philippines.

35. *Madrepora angulata*, n. sp. (Pl. IX. figs. 5–5*a*).

Corallum arborescent and rather sparsely branched, somewhat prostrate; the main stem elongated, subterete, or slightly and irregularly compressed, or twisted and acutely angular, of nearly uniform size throughout, from about 6 to 8 mm. wide, somewhat wider at its upper part where the main branches originate. The branches and chief branchlets are but slightly smaller than the main stem, rather short and angular, not coalescent; the young branchlets much smaller and tapering; they develop chiefly on opposite sides of the stem at an angle of about 50°, but many are found placed quite irregularly. Apical calicles not large, scarcely prominent, about 2 mm. wide, sometimes more, with thin edges which are not porous; star distinct, of six large, unequal septa, and six small

and sometimes rudimentary ones. Lateral calicles somewhat smaller, nearly 2 mm. wide, unequal, from 1·5 to 5 mm. long, subseriate, tubo-nariform and rostrato-nariform, not crowded; often rather widely placed, appressed, round-nariform and very short, especially on the basal parts of the stem and chief branches; star distinct, of six large septa, others smaller and rudimentary, two of the opposite, large septa generally united together almost to the very aperture. Cœnenchyma reticulated and dense; surface throughout finely or strongly costulated and echinulated.

This well-marked species is represented by a single specimen about 17 cm. high.

Locality.—Samboangan, Philippines.

36. *Madrepora diffusa*, Verrill.

Madrepora diffusa, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., vol. i. p. 41.

The specimen consists of an arborescent trunk, the larger branches of which are spreading, much divided, and rather prostrate. On the small branches and branchlets the texture of the corallum becomes very light and open, though firm; while the costæ become scarcely spinulose, and are more distinctly lamellate than on the basal parts.

Locality.—Banda.

37. *Madrepora tubigera*, Horn.

Madrepora tubigera, Horn, Proc. Acad. Nat. Sci. Philad., 1860, p. 435.

A fine specimen of this species was obtained. It consists of a much divided, prostrate stem, from which branches and branchlets arise to very different heights. Some of the branches are much subdivided and form a dense clump. The whole corallum is very porous; the calicles are large and open, and on the stem and chief branches they become immersed.

Locality.—Banda.

38. *Madrepora capillaris*, Klunzinger.

Madrepora capillaris, Klunzinger, Cor. roth. Meer., ii. p. 29, pl. iii. fig. 4.

Several fragments were obtained. The cups are often much smaller than those in Klunzinger's specimen, fragile and labellate or dimidiate. It bears a general resemblance to a small and delicate variety of *Madrepora tubigera*, but differs in the nature of the calicles and of the surface, and in the thickness of the branches.

Locality.—Banda.

39. *Madrepora echinata*, Dana.

Madrepora echinata, Dana, Zoophytes, p. 464, pl. xxxvi. fig. 1.

Two small specimens were collected. One has grown almost entirely in a horizontal direction, and thus has the calicles of the under surface much shortened or suppressed; the other is more erect. They more closely resemble the figure given by Milne-Edwards and Haime[1] than they do that given by Dana.

Locality.—Reefs, Fiji.

40. *Madrepora rosaria*, Dana.

Madrepora rosaria, Dana, Zoophytes, p. 465, pl. xxxvi. fig. 3.

Two very beautiful specimens referable to this species are in the collection. The measurements throughout are rather less than those given by Dana; and the specimens are thus examples of a rather delicate variety. A few of the branchlets are very spreading and elongated, producing new branchlets by their subdivision, and tending to give to the whole clump an uneven appearance.

Locality.—Levuka, Fiji.

41. *Madrepora parilis*, n. sp. (Pl. IX. figs. 3–3*b*).

Corallum spreading more or less horizontally, the branches and branchlets developing continuously in one plane from opposite sides of the larger branches, and of nearly equal size throughout, from about 5 to 7 mm. thick; the younger branchlets short and somewhat smaller. The branches are subterete or horizontally compressed, sometimes subangular, closely placed, and very rarely coalescent. The angle of branching is nearly a right angle. The apical calicles are rather large, from about 2 to 3 mm. wide, a little prominent, with thick and porous edges, and with a distinct star of twelve septa, of which six are rather large and unequal. The lateral calicles are wide apart, tubular, rather large, prominent, and not appressed, unequal, very sparse on the under side, where, when the branches are much compressed, they are almost absent, though forming series along the edges; they are from 1 to 2 mm. in diameter, and from 1 to 4 mm. long; others still longer give rise to branchlets. The star is quite distinct, of six large septa, with others generally more or less rudimentary. Cœnenchyma rather light and porous; surface throughout very strongly and distinctly striated or costulated with fine echinulations, which are even more marked on the calicles where the striations usually become very closely placed and thin.

This species has many points of resemblance with the *Madrepora pumila*, Verrill, but it is easily distinguished from it. Several pieces occur in the collection.

Locality.—Samboangan, Philippines, 10 fathoms; Tahiti (?).

[1] Cor., pl. E 1, fig. 4.

42. *Madrepora secale*, Studer.

Madrepora plantaginea, Dana (*non* Lamarck), Zoophytes, p. 459.
Madrepora secale, Studer, Monatsber. d. k. preuss. Akad. d. Wiss. Berlin, 1878, p. 530.

The specimens described by Dana as *Madrepora plantaginea*, Lamarck, have been referred by Verrill to *Madrepora appressa*, var.; but Studer has described it as a distinct species under the above name. A small specimen is in the collection, and its characters tend to prove that Studer's conclusion is the right one. As stated by Dana, the species may be distinguished from *Madrepora appressa* (Ehrenberg), by its calicles, which are rather stout, tubiform or very slightly compressed, often dimidiate, very unequal and but slightly appressed.

Locality.—Ternate.

43. *Madrepora appressa* (Ehrenberg).

Heteropora appressa, Ehrenberg, Cor. roth. Meer., p. 109.
Madrepora appressa, Dana, Zoophytes, p. 459, pl. xxxiv. fig. 3.

A single specimen in the collection measures nearly 1 foot in diameter, and is of rather stout growth. It has evidently grown from a central, basal attachment, but the colony has developed almost entirely in one direction as though from a lateral attachment. The branchlets are often grouped two or three together, and are united at the basal parts. At the outer part of the corallum these branchlets are shorter, much more thickened and more divided, with rather short, thickened, and less imbricated calicles.

Locality.—Amboina.

44. *Madrepora prostrata*, Dana.

Madrepora prostrata, Dana, Zoophytes, p. 447, pl. xxxiii. fig. 1.

The specimen which has been referred to this species consists of a small, prostrate branch, with many small, obliquely ascending branchlets. It seems to have been broken from the outer part of a dead clump. The calicles are broadly labellate, passing into the dimidiate form, unequal and often thickened at the base, this portion remaining rather prominent when the lip is rubbed away.

Locality.—Samboangan, Philippines.

45. *Madrepora speciosa*, n. sp. (Pl. X. figs. 1–1*b*).

Corallum shortly and narrowly pedicellate, spreading horizontally or slightly concave above; consisting of much divided and much compressed branches, from about 9 to

10 mm. wide and 4 to 5 mm. thick, which are coalescent so as to form a broad and thin lamina with numerous meshes. The under side, where the flattened, coalescent branches and branchlets are seen to form an irregular trellis-work with meshes of different sizes and shapes, is almost entirely destitute of calicles, except a few immersed ones; some large and long calicles occur, which spring from the compressed edges of the branches and give rise to small branchlets, which become closely appressed to, and ultimately fuse with, the adjacent branches. The upper side is covered throughout with closely placed clusters of very long, proliferous calicles, which are sometimes in groups of five or six, and between which occur a few shorter and immersed ones. The calicles of the clusters are tubiform, about 15 mm. long (often more or less), curved, tapering and irregularly bent, from about 3 to 4 mm. wide at their base and 1·5 mm. at their apex, and many of them carry two or three short and small, lateral calicles. At the outer, free edges of the corallum the branches are not elongated, but short and rather thick, and the calicles are short and thick proportionately and more closely placed, but never crowded. Six septa are present, and sometimes there are rudiments of a second cycle. The cœnenchyma is dense, and the surface very closely and finely echinulate. In many places, and chiefly between the coalescent branches, the surface becomes reticulate or finely fissured, so as to present a worm-eaten aspect.

In its mode of growth this species bears marked resemblance to *Madrepora granulosa*, Milne-Edwards and Haime, but its other characters easily distinguish it. A large specimen and a few fragments were obtained.

Locality.—Tahiti.

46. *Madrepora hyacinthus*, Dana.

Madrepora hyacinthus, Dana, Zoophytes, p. 444, pl. xxxii. fig. 2.

A single very large, shallow, vasiform specimen, about 40 cm. in diameter, is in the collection, and it agrees in every particular with the excellent description given by Dana. The branches are frequently, though loosely, coalescent; and often towards the centre of the vase the branchlets become very short and proliferous. The vase is very irregular in outline, owing to the unequally grown branches. The apical calicles are very uniform in size, from 2·5 to 3 mm. in diameter.

Locality.—Levuka, Fiji.

47. *Madrepora conferta*, n. sp. (Pl. X. figs. 3–3*c*).

Corallum flattened, about 2 to 3 cm. thick; branches very closely packed and much divided, densely and intricately coalescent, with narrow, elongated meshes, but with the main branches remaining distinguishable. On the under side there are numerous, coalescent

branchlets and proliferous calicles closely appressed into the plane of the frond, giving it a very rough appearance; at various parts they coalesce with the branches to form small, solid areas, in which all traces of the original forms are lost, and on which there are short, crowded, almost immersed calicles. Above, the branchlets are very short, from about 6 to 10 mm. long, rather thick (about 5 or 6 mm.) in comparison with their length, placed at right angles to the frond, obtuse and rosette-shaped at their apex, and proliferous; at the edges of the corallum they are somewhat longer and thinner. The terminal calicles are about 1·75 mm. wide, scarcely or not at all prominent, with rather thick edges and a distinct star of six septa. The lateral calicles are very small throughout, more conspicuously so at the base, rather broadly and curvedly labellate, very closely crowded, not appressed, generally erect, and with an inconspicuous star of six septa; at the apex they are gathered into a rosette of almost tubo-labellate cups around the short terminal calicle, often with a few larger proliferous ones. The rosette is much less distinct towards the outer parts of the frond. On the basal parts the calicles become quite immersed and are about 0·5 to 0·75 mm. wide. The cœnenchyma is rather dense, becoming porous and reticulate in the younger parts; the surface is echinulate and substriate, distinctly striate on the cups.

Of this species there occurs in the collection only a large, broken, flattened frond, which may have formed a portion of an irregularly grown, shallow-vasiform specimen.

Locality.—Reefs, Fiji.

48. *Madrepora cytherea*, Dana.

Madrepora cytherea, Dana, Zoophytes, p. 441, pl. xxxii. fig. 3.

Fine specimens of this species were obtained, one of which is nearly a yard in diameter and possesses a high pedicel. The branches though much flattened and coalescent are very distinct throughout, lessening gradually in size; the calicles are fragile and very long, especially the apical ones, which are often grouped in short and thick clusters. The cœnenchyma is quite light and porous in the younger parts.

Locality.—Tahiti.

49. *Madrepora vastula*, n. sp. (Pl. X. figs. 4–4*c*).

Corallum broadly and very deeply vasiform, somewhat roughly funnel-shaped and narrowly pedicellate; fronds about 4 cm. thick almost evenly to the edges; branches closely divided so as to be nearly subequal throughout, intimately coalescent even to the margin of the vase, evenly reticulated, with small, narrow meshes between them; the under side rough with numerous, appressed, coalescent branchlets, and unequal, proliferous calicles; the upper surface closely crowded with arcuate, tapering, elongated, subproliferous,

divided branchlets, which are generally evenly placed, from about 5 to 7 mm. thick, and 1 to 3 cm. long, except at the centre of the vase, where they are short and almost suppressed, and never developed with clusters of long, proliferous calicles. Terminal calicles 2 mm. wide, somewhat prominent, about 2 mm. long, with a distinct star of twelve subequal septa. Lateral calicles rather large, often nearly 3 mm. long, and from 1·5 to 2 mm. wide, crowded, labellate, with a scarcely flattened lip, somewhat fragile and rather closely placed at the apex around the terminal calicles; the basal calicles are very shortly labellate or subnariform, but many wide, immersed calicles are present; star with very narrow septa. Cœnenchyma rather dense, becoming reticulated on the distal parts; surface rough, irregularly echinulate and striate.

A single specimen of this species was obtained. It is close both to *Madrepora hyacinthus* and to *Madrepora cytherea*. The branches are very compressed vertically, much and evenly divided and coalescent, so as to form an evenly reticulated lower surface in which the main branches are indistinguishable. The even thickness of the frond gives a massive appearance to the species.

Locality.—Kandavu.

50. *Madrepora surculosa*, Dana.

Madrepora surculosa, Dana, Zoophytes, p. 445, pl. xxxii. figs. 4, 5.

Fine specimens of this species were obtained; and they show very clearly the great variability in the size and form of the branchlets, which may be short, thick, tapering quickly to a point and spike-shaped, or, in other specimens, thin and elongated.

Locality.—Tahiti.

Genus 2. *Turbinaria*, Oken.

Turbinaria, Oken, Lehrb. der Naturg., Zool., i. p. 67, 1815.
„ Milne-Edwards and Haime, Cor., iii. p. 164.
„ Duncan, Rev. Madrep., p. 184.

Seven species of this genus are in the collection.

1. *Turbinaria crater* (Pallas).

Madrepora crater, Pallas, Elench. Zooph., p. 332.
Turbinaria crater, Milne-Edwards and Haime, Cor., iii. p. 164.

Three interesting specimens of this species were collected. One, a small one, is broadly vasiform, with wavy edges and small and shallow calicles; a second is infundibuliform and contorted, with deeper and more prominent calicles; while the third is an

explanate portion, broken from a large irregular specimen much infested by parasites, having its calicles either low and shallow or rather prominent and deep.

The species is close to *Turbinaria cinerascens*, but the cups are smaller and shallower, less distinctly open, and with a smaller, oval columella. A good figure of a small specimen is given by Blainville.[1]

Localities.—Amboina; Somerset, Cape York, shore; Wednesday Island, Torres Strait, 8 fathoms.

2. *Turbinaria cinerascens* (Ellis and Solander).

Madrepora cinerascens, Ellis and Solander, Zoophytes, p. 157, pl. xliii.
Turbinaria cinerascens, Milne-Edwards and Haime, Cor., iii. p. 165.

Two small specimens, vasiform and slightly contorted, were collected. The species is close on the one hand to *Turbinaria crater*, and on the other to *Turbinaria mesenterina*, and it is doubtful, perhaps, whether it is really distinct from the latter species.

Locality.—Somerset, Cape York, shore.

3. *Turbinaria brassica* (Dana).

Gemmipora brassica, Dana, Zoophytes, p. 413, pl. xxix. fig. 1.

Two small specimens occur in the collection. The calicles are much less elongated than is shown in Dana's figure; and the general habit of the species is closely similar to that of *Turbinaria mesenterina*.

Locality.—Tongatabu.

4. *Turbinaria patula* (Dana).

Gemmipora patula, Dana, Zoophytes, p. 410.

Two specimens, one a very large and the other a small one, and a fragment, were collected. The large specimen presents an interesting variation, the edges of the calicles being very acute, the septa very narrow with the inner edges vertical and evenly prominent, and the surface roughened by coarse, sinuous striations; the upper surface is made knobby at certain parts by the lodgment of parasites, and through the development of calicles on these knobs an upright, branched growth is produced.

A dead specimen of a *Turbinaria*, from the same locality, much perforated by some boring animal, apparently belongs to this species.

Locality.—Wednesday Island, Torres Straits, 8 fathoms.

[1] Manuel d'Actinologie, pl. lvi. fig. 6.

5. *Turbinaria peltata* (Esper.)

Madrepora peltata, Esper, Pflanz. Forts., i. p. 27, Madrep. pl. xlii.
Turbinaria peltata, Milne-Edwards and Haime, Cor., iii. p. 165.

A small and very typical example of this exceedingly well-marked species was obtained.

The regularly cup-shaped form of the young specimens of this species soon becomes lost, owing to a central development of cœnenchyma which tends to fill up the cavity, while the edges of the colony become variously and irregularly contorted and plicate. By the coalescence of opposite folds, large and unequal, bifacial plates and branches are formed, which possess a uniform thickness throughout, and often attain to a very great height.

Locality.—Somerset, Cape York, shore.

6. *Turbinaria æqualis*, n. sp. (Pl. VII. figs. 3–3*a*).

Corallum consisting of narrow, rather thick plates, evenly covered on both sides with calicles. Calicles circular, not crowded, from 2 to 3 mm. apart, very small, having a diameter of from 1 to 1·5 mm.; superficial, the fossa being filled up with the septa, the proximal part of the wall not raised, the calicles being nearly even with the surface, having the opening directed upwards at right angles; septa generally from sixteen to twenty, often with a few rudimentary ones, thin, delicately spinulous, projecting quite to the centre and filling up the cavity. Columella very rudimentary, consisting of one or two papillæ, generally absent. Cœnenchyma dense; surface not striate nor echinulate, extremely granulated.

Only a fragment of a specimen of this species is in the collection. It is a narrow, twisted plate, having a basal thickness of 7 mm. It seems to have much the same habit as *Turbinaria bifrons*, Brüggemann, but differs in essential characters from that species. It is probable that in both species the bifacial development of the calicles is due to flexure and fusion of the fronds in the early stages of growth. In *Turbinaria bifrons* the proximal parts of the oblique cups are much thickened and raised; and the cups, though rather shallow, are not superficial, but present an open cavity filled up at the base by a well-developed columella.

Locality.—Wednesday Island, Torres Straits, 8 fathoms.

7. *Turbinaria stellulata* (Blainville).

Astreopora stellulata, Blainville, Man. d'Actin., p. 383, pl. lx. fig. A.

Corallum massive, with an evenly and finely porous surface; very heavy, the cœnenchyma being of a dense texture throughout, though much perforated. Calicles rather small,

about 2·5 mm. in diameter and 2 mm. in depth, from about 3 to 4 mm. apart, slightly prominent so as to form a raised margin, often a little higher on one side; many calicles scarcely or not at all raised above the general surface. Septa twenty-four, well developed, equal or subequal, often one or two very small or absent. Columella well developed, forming a conspicuous, central, trabeculate mass.

A specimen in the collection evidently belongs to this species, which is figured but not defined by Blainville as *Astreopora stellulata*, and is confounded by him and by Lamarck with *Madrepora stellulata*, Ellis and Solander. Blainville's figures are good, except that in the magnified calicles twenty septa are given instead of the normal number twenty-four. Dana, who accepts Blainville's name for the species, records it from the Fiji Islands and enumerates many of its characters; but as Milne-Edwards and Haime point out, it is really referable to *Turbinaria* and not to *Astreopora*.

Turbinaria parvistellata, Kent, is closely related to this species, being the only other recorded species of *Turbinaria* in which the corallum is massive.

Locality.—Reefs, Fiji.

Genus 3. *Astreopora*, Blainville.

Astreopora, Blainville, Dict. d. Sci. Nat., lx., p. 348, 1830.
„ Milne-Edwards and Haime, Cor., iii. p. 167.
„ Duncan, Rev. Madrep., p. 185.

A single species of this genus is in the collection.

Astreopora profunda, Verrill.

Astreopora pulvinaria, Dana (*non* Lamarck), Zoophytes, p. 415, pl. xxix. fig. 3.
„ *profunda*, Verrill, in Dana, Cor. and Cor. Islands, p. 333.

A subglobular specimen occurs. The calicles are crowded or distant, quite immersed or raised conically, being often as much as 6 mm. high. The surface is roughly, raggedly, and closely echinulate. A very striking appearance is given to the species by the numerous irregularly placed, large and swollen, prominent calicles, which may be isolated or grouped in masses, with or without immersed calicles between them.

Locality.—Banda.

Genus 4. *Anacropora*, Ridley.

Anacropora, Ridley, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 287.
„ Duncan, Rev. Madrep., p. 192.

Of this extremely interesting genus, recently described by Mr. S. O. Ridley of the British Museum [of Natural History], two species are in the collection. The only other

species of the genus at present known is the typical species *Anacropora forbesi*, Ridley, which was obtained at the Keeling Islands by Mr. H. O. Forbes.

1. *Anacropora gracilis*, n. sp. (Pl. X. figs. 6–6*c*).

Corallum small, fruticose, much branched, very porous throughout, light and fragile. Branches very coalescent, of nearly equal size throughout, about 4 mm. thick, often less, regularly dichotomous, with a widely opened angle, sometimes divaricate; branchlets of nearly the same thickness as the branches, short, rounded at the ends, and very easily broken away. Calicles very delicate and much raised, about 1 mm. high, subseriate, about 2·5 mm. apart, often much less, round and open nariform, slightly swollen, about 1·25 mm. wide, with a comparatively large aperture. Septa twelve, unequal, two of the primaries rather large. Cœnenchyma extremely loose and porous throughout; surface very finely, closely, and strongly echinulate, especially on the edge of the calicles, harsh to the touch.

This is a much more delicate and fragile species than *Anacropora forbesi*, Ridley. It is smaller and thinner throughout, much more coalescent, with a much harsher and more finely spinulose surface; it is strikingly porous and is destitute of any superficial layer of dense tissue. The calicles are very easily abraded by the touch, and will generally be found to be very slightly prominent on that account in specimens which have been much handled. The clump is about 6 cm. high, and rather more in width.

Locality.—Banda.

2. *Anacropora solida*, n. sp. (Pl. X. figs. 7–7*a*).

Corallum arborescent and slightly ramose, dense, not fragile. Branches originating irregularly at an open angle, sometimes divaricate, somewhat elongated, from about 6 to 7 mm. thick; branchlets thinner, strong, tapering, subacute, rather long, sometimes nearly 2 cm. in length. Calicles very small, slightly raised, round nariform, seriate or subseriate, about 2·5 mm. apart. Septa twelve, six larger and subequal, six very small and sometimes rudimentary. Cœnenchyma very dense and solid, becoming slightly reticulate in the internal portion of the apical parts of the branches and branchlets surface finely echinulate or granulated.

This species, though having much of the habit and size of *Anacropora forbesi*, Ridley, is very distinct in the nature of its cœnenchyma, which is dense and firm, rendering the corallum heavy. The calicles are also smaller and less raised, and the septa less developed. Only two fragments of this species were obtained.

Locality.—Kandavu.

Genus 5. *Montipora*, Quoy and Gaimard.

Montipora, Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 247.
„ Milne-Edwards and Haime, Cor., iii. p. 207.

This genus includes a large number of species, and like the closely related *Madrepora* presents considerable variation in form and structure when the various species are compared. Thus the prominence of the calicles and the papillose nature of the cœnenchyma, which often forms monticular, intercalicinal eminences, are so marked in certain forms that it has been considered not improbable that, on these grounds, the genus may have to be divided. This apparent distinctness has been noticed long ago by Verrill,[1] who at the same time pointed out that the smoothness and evenness of the cœnenchyma and calicles, which are so marked in some ramose forms, pass insensibly into the papillose and prominent condition in others, the two characteristics being even present on different parts of specimens of one and the same species: so that these characters are not available for generic separation.

Again, the characters presented by such massive species as *Montipora foveolata*, in which the septa, which are subequal at their upper part, are considerably sunk in deep pits, at the bottom of which the primary septa are thickened and united, seem at first sight to offer a means of subdividing the genus; but here again the transitional forms through *Montipora caliculata* and *Montipora verrucosa* prevent any such subdivision.

This genus and the allied *Madrepora* furnish striking examples of the difficulty which is constantly encountered in framing generic limitations among the Corals.

Twenty-two species of the genus were obtained.

1. *Montipora palmata* (Dana).

Manopora palmata, Dana, Zoophytes, p. 493, pl. xliv. fig. 2.

The papillæ give a characteristic appearance to this fragile species, and are developed in connection not only with the cœnenchyma but also with the lower edge of the calicles, so as to form prominent, well-marked portions, giving a rough appearance to the corallum. The form and arrangement of these spinules are shown by Dana (pl. xliv. fig. 2*c* and 2*d*). On the under surface of the branches the spinules are often very short, the cœnenchyma becoming in this case simply uneven.

Locality.—Reefs, Fiji.

2. *Montipora fragilis*, n. sp. (Pl. VIII. figs. 1 1*b*).

Corallum small, arborescent, ramose, very light and fragile on the younger parts, becoming denser at the base; branches about 7 mm. thick, much compressed and

[1] *Proc. Essex Inst.*, vol. v. part 3, p. 26.

coalescent, sometimes rounded; branchlets short, somewhat thinner than the branches, generally much compressed, sometimes terete and tapering. Calicles very small and immersed, about 0·25 mm. wide, not crowded, scarcely conspicuous between the close and long papillæ of the surface. Septa unequal, six being distinct, the secondaries rudimentary. Cœnenchyma very light and porous, widely reticulate above, becoming less porous below; surface covered by long very crowded papillæ, which at the basal part of the corallum are short, unequal, generally rounded, about the same size as the cups, and closely crowded by minute spinules, while at the distal part they are very elongated, thinner, and somewhat raggedly divided into spinules.

This species is close to *Montipora palmata*, but is distinguished by its lighter and more porous structure, by the much smaller and less crowded calicles, and by the much more densely papillose nature of the surface, the papillæ being much more elongated and ragged, especially towards the distal parts.

Locality.—Banda.

3. *Montipora rubra* (Quoy and Gaimard).

Alveopora rubra, Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 242, pl. xix. figs. 11–14.
Montipora rubra, Milne-Edwards and Haime, Cor., iii. p. 209.

Several small specimens were obtained which seem referable to this species. The corallum, especially at the basal parts, is compressed, becoming subterete and attenuated above, though often rounded at the end. The surface is destitute of spinules or tubercles, but is rendered very uneven owing to the slightly raised, outer borders of the deeply placed calicles, which are thus surrounded by small, and rather fragile, subpolygonal or subcircular projections.

Montipora poritiformis, Verrill, is very close to this species, but apparently is separated by its round branches, and the less-developed projections around the calicles.

Locality.—Reefs, Fiji.

4. *Montipora levis*, n. sp. (Pl. VIII. figs. 2–2*a*).

Corallum small, ramose; branches about 7 mm. thick, much compressed and coalescent, forming broad, palmated expansions, sometimes subterete; branchlets somewhat thinner than the branches, subterete and generally acuminate, rather short, often compressed. Calicles immersed, small and crowded, from about 0·25 to 0·5 mm. wide, and from 1 to 1·25 mm. apart. Septa very thin, the primaries conspicuous and broad, the secondaries very small. Cœnenchyma finely porous, becoming dense below. Surface very finely spinulose or granulated, reticulate and even, sometimes slightly roughened, never papillose nor tuberculate.

This species, though agreeing in general habit with *Montipora palmata*, differs markedly in the nature of its surface, which brings it into close relation with *Montipora poritiformis*, *Montipora digitata* and *Montipora tortuosa*. A variety occurs on the Fiji Reefs which is very close to *Montipora digitata*, but differs in its much more compressed branches, and in its cells, which are not sunk towards the extremities of the branches in large depressions, so as to give a pitted appearance to the surface. The presence of large, pit-like depressions, in which the calicles are situated, forms an essential character of each cell of *Montipora digitata*, as described by Dana.

Localities.—Banda; reefs, Fiji.

5. *Montipora rigida*, Verrill.

Montipora rigida, Verrill, Proc. Essex Inst., vol. v. part 3, p. 26

A very interesting specimen of this species was obtained. The cœnenchyma is very firm, but at the extremities of the well-developed branches and branchlets it becomes very loose and porous, and almost fragile. The calicles of the basal parts are as described by Verrill, but they are easily abraded, and thus become even with the surface. At the apical parts they are not prominent, but are surrounded by a thin, scarcely raised line.

Brüggemann has referred this species to *Montipora* (*Madrepora*) *limitata*, Ellis and Solander, but the identification seems to me doubtful.

Locality.—Mactan Island, Philippines.

6. *Montipora irregularis*, n. sp. (Pl. VIII. figs. 4–4*a*).

Corallum incrusting and spreading at the base, forming thick, irregular, nodular processes above, which develop into much divided branches. Branches thick, closely placed, ascending, often coalescent, and becoming broad and almost palmated; very unequal in length and thickness, compressed, subterete or nearly round, never angular. Branchlets about 12 mm. thick, sometimes compressed, generally rounded, scarcely elongated, and tapering slightly to an obtuse apex. Calicles quite immersed, rather large, about 1 mm. wide, slightly larger on the prominent parts, very crowded, separated by spaces generally much narrower than their diameter, very deep. Septa of two cycles, unequal, rather prominent, and very thin. Cœnenchyma, extremely porous; surface furnished neither with papillæ nor tubercles, but having the narrow intercalicinal spaces delicately echinulate.

This species has many points of resemblance both with *Montipora divaricata*, Brüggemann, and with *Montipora digitata* (Dana), but can be readily distinguished from both of these forms.

Locality.—Samboangan, Philippines.

7. *Montipora obtusata*, n. sp. (Pl. VIII. figs. 3–3*a*).

Corallum consisting of a broad, spreading, rather thin, and unevenly undulated plate, uniformly about 5 mm. thick, from the upper surface of which arise numerous short, thick, obtuse, sometimes subclavate, slightly compressed, irregular branches which may be as much as 2·5 cm. long and 1 cm. thick, and may coalesce laterally to form thick masses. The edge of the plate is slightly turned up, rounded, and uniformly thick; the under surface is covered by a slight epitheca and incrusted by foreign matter almost to the margin where a few small calicles are found. Calicles small, about 0·5 mm. wide, immersed, never sunk in pits, but even with the surface, from about 1 to 2 mm. apart; septa twelve, unequal, almost filling up the cavity of the cell, the secondaries often rudimentary. Cœnenchyma finely reticulate, but firm and rather dense; surface nearly smooth, very minutely spinulose, never papillose nor tubercular.

The broad, spreading, basal plate, with the short, erect lobes or branches, the smooth surface, and the characters of the calicles, will readily serve to distinguish the species.

Locality.—Reefs, Fiji.

8. *Montipora patula*, Verrill.

Montipora patula, Verrill, Proc. Essex Inst., vol. vi. p. 87.

This species is represented by a very fine specimen, which at its centre incrusts dead branches of *Madrepora*, and has numerous short prominences on its upper surface due to the presence of parasitic growths. The cells are normally twelve-rayed, but in many parts, towards the edges of the corallum, the septa of the second cycle are quite rudimentary.

Locality.—Amboina.

9. *Montipora exserta*, n. sp. (Pl. VIII. figs. 5–5*b*).

Corallum forming a rather thin, flattened, broad, horizontal plate, about 8 mm. thick, lessening in thickness towards the edges, but never very thin, even close to the margin; often incrusting foreign matter and thus becoming uneven. The cœnenchyma is dense throughout and evenly reticulate, the surface appearing almost smooth, being very finely and minutely echinulate, never papillose nor tubercular. The under surface is covered to a short distance from the edge by a layer of rudimentary epitheca and foreign matter; and where this is very thin or absent, the finely spinulose cœnenchyma, and small, immersed calicles, which are evenly and closely arranged throughout, are distinctly seen. On the upper surface the calicles are rather large, about 0·75 mm. in diameter, immersed, very regularly arranged, about 1 mm. apart or less. Septa twelve, the secondaries very small; two opposite primary septa much enlarged and exserted, so as to be easily seen

projecting above the surface as small points, separated above by a small notch, but uniting into a plate across the cavity of the cell. This condition is much more marked towards the central parts, where the prominent septa give a somewhat bristling aspect to the corallum.

The closest ally of this very distinct species is *Montipora complanata* (Lamarck). A single specimen was obtained, the growth of which is frequently disturbed by worm tubes.

Locality.—Wednesday Island, Torres Straits, 8 fathoms.

10. *Montipora foliosa* (Pallas).

Madrepora foliosa, Pallas, Elench. Zooph., p. 333.
Montipora foliosa, Milne-Edwards and Haime, Cor., iii. p. 212.

This common species is represented by numerous specimens and fragments.

Locality.—Amboina.

11. *Montipora exesa*, Verrill.

Montipora exesa, Verrill, Proc. Essex Inst., vol. vi. p. 84.

A large fragment in the collection is referable to this species, which was described by Verrill from a single large frond. The basal part of the outer fronds is largely incrusted by *Millepora gonagra*, and above the incrustation the surface is finely papillose; among the papillæ several rather large, raised cells occur bearing numerous smaller papillæ. Towards the edges the calicles are fewer and scarcely raised, and the surface is very finely striated and porous, and destitute of papillæ. The inner fronds are scarcely papillose.

The species is very close to *Montipora lima*.

Locality.—Samboangan, Philippines.

12. *Montipora lima* (Lamarck).

Agaricia lima, Lamarck, Hist. Anim. sans Vert., ii. p. 243, 1816.
Montipora lima, Milne-Edwards and Haime, Cor., iii. p. 213.

This species is represented by a fine and large specimen. On the basal parts of the more exposed, upper fronds, the papilliform ridges and crests become much thicker and higher, and more irregular than on the others. The calicles on the under side are very small and sparse at the edges, but become larger and more numerously placed at the basal part, where, in the outer fronds, the surface is closely and finely papillose.

Locality.—Samboangan, Philippines.

13. *Montipora grandifolia* (Dana).

Manopora grandifolia, Dana, Zoophytes, p. 499, pl. xlv. fig. 1.

Two fragments were obtained. The specimen was evidently of small growth, the fronds being scarcely 5 cm. high, with a thickened base by which they were attached. The small, crowded, short cells cover almost the entire outer surface, except for a very short distance from the upper edge.

Locality.—Api, New Hebrides.

14. *Montipora papillosa* (Lamarck).

Agaricia papillosa, Lamarck, Hist. Anim. sans Vert., ii. p. 243, 1816.
Montiporá papillosa, Milne-Edwards and Haime, Cor., iii. p. 216, pl. E 3, fig. 2.

A small incrusting specimen of this species was obtained. The longitudinal series of papillæ are very distinct, but at times they are very small and angular, not thick and rounded.

Locality.—Tahiti.

15. *Montipora verrucosa* (Lamarck).

Porites verrucosa, Lamarck, Hist. Anim. sans Vert., ii. p. 271, 1816.
Montipora verrucosa, Milne-Edwards and Haime, Cor., iii. p. 214.

A few small specimens were obtained. The species, apparently, may assume a branched form, for in one specimen a small branch has developed on one of the gibbosities. The comparatively large, open, deep cells, with the alternately large and small septa meeting at the bottom of the cell, will serve to distinguish this species from *Montipora capitata* (Dana).

Locality.—Reefs, Honolulu, and from depths of 1 to 2 fathoms.

16. *Montipora capitata* (Dana).

Manopora capitata, Dana, Zoophytes, p. 504, pl. xlvii. fig. 4.

Small specimens of this species were obtained. Though very close to *Montipora verrucosa*, it seems to be sufficiently distinguished by its decidedly branched form, its smaller cells, and the broader septa, which tend to fill up the cavity of the cell, as well as by the thinner, closer, and more unequal tubercles of the surface.

Locality.—Reefs, Honolulu, and from depths of 1 to 40 fathoms.

17. *Montipora foveolata* (Dana).

Manopora foveolata, Dana, Zoophytes. p. 507.

The walls of the calicles in this species are very finely porous, often much thickened, and frequently, at the angles of the calicles, they are much and sharply elevated. The

twelve septa are subequal at their upper portion and project but slightly into the fossa, but at the bottom of the calicles the primaries become thickened, and meet at the centre.

The wide pits and deeply immersed cells of this species give it a characteristic appearance. In the structure of its cells it much resembles *Montipora verrucosa*. In general form it is very like the figure of *Porites reticulosa* given by Dana.[1]

Locality.—Kandavu.

18. *Montipora caliculata* (Dana).

Manopora caliculata, Dana, Zoophytes, p. 492, pl. xliv. fig. 1.

A fragment of a specimen was obtained. The species has, at first sight, much of the aspect of an incrusting *Madrepora*, but it differs essentially from the forms of that genus in the fact that growth does not take place by budding around one or more leading calicles. The developing calicles arise irregularly from the cœnenchyma, and are generally much more prominent than the adjoining calicles, and thus give an uneven surface to the corallum. The species is very close to *Montipora foveolata*, from which it differs chiefly in its smaller calicles, which are generally distinctly separated by rounded walls, and in its less porous and more spinulose cœnenchyma. The twelve septa are deeply sunk within the calicle, and are exceedingly narrow, leaving a wide central cavity. At the bottom of the calicle the primaries are thicker than the secondaries and are united to one another at the centre.

Locality.—Kandavu.

19. *Montipora scabricula* (Dana).

Manopora scabricula, Dana, Zoophytes, p. 502, pl. xlvi. fig. 3.

A single large specimen was obtained. The edges of the corallum are rather thickened, closely adherent or slightly folded under. The surface is closely and minutely spinulose, but the spinules are very unequal and are frequently placed close to the calicles, which thus become, apparently, somewhat prominent. This character, taken with the small, irregular gibbosities of the surface, gives the corallum a rather rough and peculiar appearance. The six primary septa meet at the centre deep down in the cell, where two of them are usually more thickened and prominent.

Locality.—Reefs, Fiji.

[1] Zoophytes, pl. lvi. fig. 3.

20. *Montipora erosa* (Dana).

Manopora erosa, Dana, Zoophytes, p. 504, pl. xlvi. fig. 5.

The specimen in the collection is much worn, thick and massive. The lobes are much less angular than in Dana's figure; and the cells are twelve-rayed, six being large and conspicuous, and the others very small and spinulose.

Locality.—Mactan Island, Philippines.

21. *Montipora effusa* (Dana).

Manopora effusa, Dana, Zoophytes, p. 500, pl. xlvi. fig. 4.

The single specimen is a thin and widely explanate, incrusting plate, which is free at the margin for a considerable distance. The surface consists of a very open and evenly reticulated cœnenchyma, becoming denser within. The spinules are rather large, and are closely gathered around the cups on all the raised portions of the corallum, becoming small and often absent on the concave portions. It seems altogether a rather delicate variety of the species.

Locality.—Samboangan, Philippines.

22. *Montipora aspera*, Verrill.

Manopora crista-galli, Dana (*non* Ehrenberg), Zoophytes, p. 494, pl. xlvi. fig. 1.
Montipora aspera, Verrill, in Dana, Cor. and Cor. Islands, p. 333.

This species differs from *Montipora crista-galli* chiefly in its much more massive and uneven growth, the branches being scarcely laminate. The whole corallum is rendered extremely rough by the development of numerous angular wings, crests, and short, longitudinal rows of papillæ, which are very irregularly scattered. The calicles are very distinct, rather close between the crests and angular branches, and somewhat indistinctly and unequally six-rayed; in many cells a rudimentary second cycle is developed.

Locality.—Tahiti.

Family Poritidæ.

Genus 1. *Porites*, Lamarck.

Porites (pars), Lamarck, Hist. Anim. sans Vert., ii. p. 267, 1816.
„ Milne-Edwards and Haime, Cor., iii. p. 173.
„ Duncan, Rev. Madrep., p. 187.

It has already been shown by Verrill in his description of the Corals of the West Coast of America that the presence of two cycles of septa is not always characteristic of

Porites, for a much larger number of septa frequently occurs. In a very interesting new species, *Porites mirabilis*, obtained by the Challenger from the reefs at Mactan Island, this condition is more highly developed than in any of the species from the American coast. In this species many very large calicles are found, often at close intervals, among the ordinary sized calicles; and in these large calicles three or four cycles of septa are present, the fourth cycle being more or less incomplete. In correspondence with this, the number of pali is also increased, twelve, sixteen or more being present in these cups.

The most interesting character, however, which is revealed by these specimens is the occurrence of the mode of increase by fission in *Porites*, a condition which has usually been regarded as absent in the Poritidæ, in which gemmation was constantly observed. Fission occurs in not a few of the smaller calicles, and is normal in the larger kind of calicles.

The occurrence at Mactan Island of this very marked species, which presents characteristics hitherto observed only in species from the West Coast of America, is an extremely interesting fact. The Coral fauna of the West Coast of America is thus closely related to that of the Western Pacific districts, not only through this form, but also through the new species *Dendrophyllia conferta*, from Australia, which very closely resembles *Dendrophyllia surcularis*, from the American coasts, and through *Stephanaria stellata*, which is found on the American coasts and in the Sandwich and Fiji Islands.

Eighteen species of this genus were obtained.

1. *Porites clavaria*, Lamarck.

Porites clavaria, Lamarck, Hist. Anim. sans Vert., ii. p. 270, 1816.
„ „ Milne-Edwards and Haime, Cor., iii. p. 175.

This species, as pointed out by Pourtalès, is very close to *Porites furcata*, and it becomes a matter of difficulty in some cases to distinguish between them. Apart from the size and shape of the corallum, the development of the columella, however, seems to be a generally constant character. In *Porites furcata* the columella is usually scarcely visible in the small cell, while in the larger cells of the *Porites clavaria* it becomes comparatively large and but slightly smaller than the pali.

The specimens in the collection are about 13 cm. high, with diverging, scarcely compressed, dichotomously divided branches, 2 cm. thick. They are much thicker than, but otherwise not unlike, the specimen figured in the Report on the Florida Reefs, pl. xii. fig. 7, which Pourtalès has referred to *Porites furcata*, but the calicles of which, figured on pl. xvi. fig. 14, seem to be characteristic ones of *Porites clavaria*.

Locality.—Bermuda.

2. *Porites bulbosa*, n. sp. (Pl. XI. figs. 7-7*a*).

Corallum slightly incrusting at the base, much ramose; branches rather short, thick, subterete or slightly compressed, sometimes coalescent, terminating above in much swollen, clavate knobs with truncated apex, often bifurcate and generally much constricted at the basal part of the knob. Calicles rather small, about 1·5 mm. wide, often less, superficial on the incrusting part, and slightly excavated above, never deep; in those calicles on the inner part of the corallum the walls are generally thin, with distinct septa, and a distinct circle of small pali enclosing a small styliform columella; in those on the outer part the walls are thick, from one-quarter to one-half the diameter of the cell, with a very distinct circle of larger and longer pali surrounding a larger columella, but the septa are much shorter, and less clearly distinct from the wall. The wall is reticulated and rather ragged, and the septa and pali are granulated. Texture firm, reticulated and porous, especially at the apical parts.

This species though close to, is easily separable from *Porites mordax*. In the general form of the corallum it closely resembles *Porites clavaria*. It is represented by a fine and large specimen, the knobs of which are about 25 mm. thick, lessening to 15 mm. at the constricted part.

Locality.—Reefs, Honolulu, and at depths of from 1 to 2 fathoms.

3. *Porites palmata*, Dana.

Porites palmata, Dana, Zoophytes, p. 558, pl. liv. fig. 3.

A very fine example and some small fragments of this species were obtained. The cells are of very variable size, from 1 to 2·5 mm. wide; and the pali are distinct, long, thin, and prominent.

Localities.—Samboangan, Philippines; Amboina.

4. *Porites compressa*, Dana.

Porites compressa, Dana, Zoophytes, p. 553, pl. liii. fig. 5.

The walls of the calicles throughout are very finely and raggedly spinulose, and owing to this the specimen is very rough to the touch. The septa are very granulated and spinulose; the pali very distinct, small and generally elongated, and the columella elongated and distinct, though small.

A single rather small specimen was obtained.

Locality.—Honolulu.

5. *Porites explanata*, n. sp. (Pl. XI. figs. 3–3*a*).

Corallum incrusting, thin, about 2·5 mm. thick, explanate, undulate, or gibbously convex, sometimes mammillate, fixed at the central part and free for a large portion at the margin, which is unevenly flexed. Under surface with a strong epitheca, distinctly striated and concentrically ridged. Calicles from about 1 to 1·5 mm. wide, very shallow, almost inconspicuous owing to the walls being scarcely distinct, very porous and loosely reticulate. Septa generally indistinct and unequal, joined within, the second cycle generally incomplete; pali four, five or six, small, almost indistinguishable from the echinulations of the wall, but always surrounding a small and distinct depression in which no columella can be perceived. Texture light and porous.

A single small specimen of this species was obtained. It has much general resemblance to an explanate *Montipora*, and in its essential characters presents on the one hand an approach to that genus, and on the other to *Synaræa*.

Locality.—Samboangan, Philippines.

6. *Porites lichen*, Dana.

Porites lichen, Dana, Zoophytes, p. 357, pl. lvi. fig. 4.

A very large specimen and several fragments show well the variation in form of this species. The edges are free for a very large portion, undulate and revolute, and often quite thin and contorted, but sometimes rather thickened and mammillate; the fixed and incrusting, central portion is quite thick and mammillate. The cells are from 1 to 2 mm. wide, rather shallow, but never superficial; the pali are small and often scarcely apparent; the walls are thin and raised and have a somewhat ragged outline.

The characters of these specimens seem to point to the identity of *Porites lichen* and *Porites reticulosa*.

Locality.—Reefs, Honolulu, and from depths varying from 1 to 40 fathoms.

7. *Porites guadalupensis*, Duchassaing and Michelotti.

Porites guadalupensis, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 83.

The species is closely allied in the sum of its characters to the massive species, *Porites arenosa* and *Porites conglomerata* from the Pacific and the Red Sea. Its walls are subcircular or neatly polygonal, thin and raised, being very distinct, resembling the structure in *Rhodaræa*. The septa are thin at their upper part, projecting but slightly from the wall, thick and projecting almost to the centre within, where the pali are found to be irregularly developed and inconspicuous, from six to one in number, or absent. Columella almost invariably absent. Size of calicles about 2 mm.

Specimens of this species were found with *Porites superficialis*, forming bright yellow, or whitish-pink, rounded masses in the rock pools.[1]

Locality.—St. Vincent, Cape Verde Islands.

8. *Porites superficialis*, Duchassaing and Michelotti.

Porites superficialis, Duchassaing and Michelotti, Mém. Cor. des Antilles, p. 82.
Neoporites michelini, Duchassaing and Michelotti, Suppl. Mém. Cor. des Antilles, p. 98., pl. x. figs. 9, 10.

A single specimen of this species was obtained. It forms a small, convex, slightly irregular mass incrusting a nodule of calcareous matter. Of the two species which I have placed together, there does not seem to be any marked character which is not common to both as described by Duchassaing and Michelotti. The very small calicles are specially noticed under *Porites* (*Neoporites*) *michelini*, but this is a most inconstant character in these massive and incrusting species, and at different parts of the same specimen very different measurements can be obtained, depending not only upon the simple size of the calicles, but also on their distance from each other.

Locality.—St. Vincent, Cape Verde Islands.

9. *Porites astræoides*, Lamarck.

Porites astreoides, Lamarck, Hist. Anim. sans Vert., ii. p. 269, 1816.

A specimen of this very common West Indian species was obtained. Very good figures of the species are given in the Report on the Florida Reefs, pl. xvi.

Locality.—St. Thomas.

10. *Porites crassistellata*, n. sp. (Pl. XI. figs. 4–4*a*).

Corallum incrusting at the base, massive, gibbous, unevenly and unequally mammillate. Calicles very uneven, subcircular or angular, rather deep but often very shallow, rather large, about 2 mm. wide, often less, arranged either in series along raised, ridge-like projections and in corresponding depressions, or scattered irregularly, many being much raised above surrounding ones; walls very thick, angular, unequally raised and thickened, having at times the appearance of tubercles between the cups; by the development of young calicles on the raised, thickened portions of the wall, the surface becomes very uneven, and often ridged; septa rough, unequal, thick, often united within, but scarcely prominent on the upper part of the wall. Interseptal spaces very narrow and slit-like. Pali from six to eight, thick and blunt, distinct and long in a few cups, but generally

[1] Moseley, Notes by a Naturalist on the Challenger, p. 48.

short and not at all prominent. Columella very small and generally inconspicuous, often absent. Surface very granulated and minutely spinulous. Texture of corallum rather dense and heavy, closely reticulate or fissured.

In general appearance this species somewhat resembles *Porites astræoides*, but its structure is quite different. A single small specimen was obtained.

Locality.—Kandavu.

11. *Porites arenosa* (Esper).

Madrepora arenosa, Esper, Pflanz. Forts., i. p. 80, Madrep. pl. lxv.
Porites arenosa, Milne-Edwards and Haime, Cor., iii. p. 180.

This widely distributed species is represented by numerous specimens. It is very close to *Porites lutea*, but seems to be sufficiently distinguishable by the much more lobed and mammillated corallum, by the very thin and small, elongated cells in the depressions, by the deeper cells with very conspicuous interseptal spaces, by the longer and thinner pali, and by the more spinulous walls.

Localities.—Tahiti; Tongatabu; Banda; Kandavu, and other reefs, Fiji.

12. *Porites gaimardi*, Milne-Edwards and Haime.

Porites gaimardi, Milne-Edwards and Haime, Cor., iii. p. 179.

A single specimen was obtained. It forms a thick, erect, rather elongated mass, slightly flattened above. The cups are about 1·5 mm. wide, and the columella is very distinct, though small.

Locality.—Banda.

13. *Porites crassa*, n. sp. (Pl. XI. figs. 2–2*a*).

Corallum massive, uneven, irregularly monticulose and mammillate, incrusting at the base. Calicles deep, moderately large, from 1·5 to 2 mm. wide, not plane at the bottom; walls spinulous, sometimes thin, but generally very thick and porous, being about one-fourth or one-half the width of the cell; young developing cells very abundant on the thick walls. Septa subequal, often rather thick and prominent, joined two and two in the depth of the cup, where a very distinct circle of well-developed, rather long, generally thin and pointed pali is visible. The interseptal spaces very wide and distinct. Columella absent or quite inconspicuous. Texture very porous but firm.

This species has many points of resemblance with *Porites fragosa*, but differs markedly in its deep cells which are not plane at the bottom, and also in its thicker walls and larger cells. A single small specimen was obtained.

Locality.—Reefs, Fiji.

14. *Porites lutea*, Milne-Edwards and Haime.

Porites lutea, Milne-Edwards and Haime, Cor., iii. p. 180.
„ „ Klunzinger, Cor. roth. Meer., ii. p. 40, pl. v. fig. 16.

A small specimen was obtained. It differs in no important particular from the Indian Ocean specimens of the species.

Locality.—Mactan Island, Philippines.

15. *Porites parvistellata*, n. sp. (Pl. XI. figs. 8–8*a*).

Corallum massive, convex or subcolumnar, unevenly gibbous and closely monticulose, or small-mammillate, incrusting at the base. Calicles polygonal, very small, about 1 mm. wide, sometimes less, deep, becoming rather shallow on the incrusting part, not plane at the bottom; walls acute, very thin above, rather thick below, nearly solid. Septa unequal, short, narrow, nearly solid, often joining two and two deep down in the cup, where a circle of small, often elongated pali is visible. Columella absent or inconspicuous. Texture very firm and compact for the genus; the interseptal spaces being very small.

The mode of growth, the compact texture, and the very small and deep cups, with thin, acute walls and narrow, short septa, distinguish this species. Two small specimens were obtained; one of which is about 7 cm. high and 5 cm. broad, not unlike an enlarged mulberry in appearance.

Locality.—Api, New Hebrides.

16. *Porites tenuis*, Verrill.

Porites tenuis, Verrill, Proc. Essex Inst., vol. v. pt. 3, p. 25.

Very interesting specimens of this species were obtained. They occur either as unattached, rounded and uneven masses, covered over the whole surface by living polyps, or attached, being then fixed by a narrow base or growing incrusting over stones and other foreign material. The walls are very thin and porous, the central portion slightly raised, very neatly polygonal, and conspicuous on the surface as fine lines. The septa, pali, and columella are small and very distinct; and the small interseptal spaces are very conspicuous.

In one specimen, which is fixed and very broad, the summit is dead owing to exposure in an insufficient depth of water, while growth has continued in a lateral direction.

Localities.—Api, New Hebrides; Honolulu, at depths of from 1 to 2 fathoms.

17. *Porites mirabilis*, n. sp. (Pl. XI. figs. 5–5*a*).

Corallum massive, convex and gibbous, incrusting at the base. Calicles very unequal, of two distinct sizes, with many intermediate ones; the smaller more numerous, from 1 to 1·5 mm. wide, sub-polygonal, nearly superficial, but slightly excavate, with rather narrow, acute walls, often thickened and very porous, with very thin septa, five or six unequal, distinct, long pali, and a styliform columella. The larger calicles often closely gathered together, but generally separated by from two to five smaller ones, about 2·5 mm. wide, sometimes more, much more excavated than the small ones, with very thin and closely placed septa of three or four cycles, the fourth cycle being incomplete, with from twelve to sixteen, or more, thin and distinct pali surrounding a styliform, or subtrabeculate, or porous columella. Texture close and firm, very finely reticulated.

A single small specimen, nearly 8 cm. in diameter, was obtained. It is easily distinguishable from all other known species of the genus, though an approach is made to it by *Porites porosa* and *Porites excavata*, from the West Coast of America.

Locality.—Mactan Island, Philippines.

18. *Porites latistellata*, n. sp. (Pl. XI. figs. 6–6*a*).

Corallum incrusting at the base and almost massive, becoming subramose or deeply lobate above, the lobe-like branches being from about 1 to 2 cm. thick, about 2 cm. long at the outer part of the colony, but very short and almost suppressed towards the central portion; slightly swollen and fragile at the apex, subtruncate, very coalescent and often compressed. Calicles angular, large, about 3 mm. wide; towards the basal parts they are often smaller, and almost or quite superficial, the walls being very thin, acute, and slightly raised, often almost indistinguishable; towards the apical parts the calicles are deeper, and on the subtruncate ends they become much excavated, though never as deep as they are wide, with very thin, acute, subcircular or elongated walls. Septa from twelve to sixteen, often rather indistinct, joined at the centre, and ragged, bearing numerous paliform lobes; in the superficial calicles they are rather distinct, with from six to eight small pali surrounding a porous columella; in the deep calicles they are often almost indistinguishable, very porous and trabeculate, while the pali form a distinct, circular, raised, trabeculate mass nearly confluent with the columella. Texture exceedingly light and loosely porous, surface very spinulose and granulated.

In the shape of its cells the species has much in common with *Porites favosa;* while many of its essential characters indicate an approach to the genus *Napopora*. A rather large specimen was obtained.

Locality.—Tahiti.

Genus 2. *Napopora*, Quelch.

Napopora, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 296.

Corallum compound, porous. Gemmation intracalicinal, the developing buds with distinct centres, almost destitute of distinct walls, at first united in groups of from two to six, and surrounded by the common wall of the parent calicle; but as development proceeds, they are separated off by a narrow, raised, distinct wall. Calicinal depressions very variable in size and shape, according to the number, position, and degree of development of the buds. Walls of the older calicles porous, distinctly raised, angular. Septa generally of two cycles, rudimentary. Pali six, sometimes one smaller than the others or absent, generally well developed, and distinctly marking the position of the calicinal centres. Columella rudimentary, represented by small, papilliform projections, often absent.

This genus is peculiar among the Poritidæ in the arrangement of its calicles, which present an approach to a meandrine condition. Its closest ally is *Synaræa*, but in this latter genus the walls are not developed.

Napopora irregularis, Quelch (Pl. VIII. figs. 6–6*a*).

Napopora irregularis, Quelch, Ann. and Mag. Nat. Hist., vol. xiii., 1884, p. 296.

Corallum ramose; branches rather short, moderately thick, obtuse, and slightly or not at all compressed. Calicles very variable, seen in all stages of development, with many granular points or flattened projections; the single calicles with distinct walls, subcircular, about 2 mm. in diameter; the larger ones with many distinct centres in the same cavity, surrounded by a common wall, which is raised, angular, and of irregular shape, with a diameter of from 4 to 9 mm. Many of the developing centres present no trace of a wall, others possess walls more or less incomplete; but the centres are easily distinguished by the position of the pali. The septa of two or three cycles, generally twelve, sometimes fewer, rudimentary, sometimes rather distinct at their inner ends, and united two by two where the pali are placed. The pali are generally six in number, prominent, sometimes one very small or absent. Columella inconspicuous.

Of this species there is a single small specimen. It consists of a broken, slightly compressed branch about 5·5 cm. long, with three branchlets, one of which is broken off. The widest diameter of the branches is about 1·25 cm., and of the branchlets about 1 cm., even close to the apex. The surface is delicate and easily abraded. The species presents an approach to *Porites latistellata*.

Locality.—Tahiti.

Genus 3. *Synaræa*, Verrill.

Synaræa, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., i. p. 42.
„ Duncan, Rev. Madrep., p. 187.

A single species of this very interesting genus was obtained.

Synaræa convexa, Verrill.

Synaræa convexa, Verrill, Bull. Mus. Comp. Zoöl., Cambridge, U.S.A., i. p. 43.

The branches in this species are often coalescent throughout, leaving small, very irregular and unequal depressions on the upper surface, in which the cells are delicate and very closely placed. Several pieces of a large specimen were obtained.

Locality.—Tahiti.

Genus 4. *Goniopora*, Quoy and Gaimard.

Goniopora, Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 218.
„ Milne-Edwards and Haime, Cor., iii. p. 189.
„ Duncan, Rev. Madrep., p. 189.

A single specimen of the typical species of the genus was obtained.

Goniopora pedunculata, Quoy and Gaimard.

Goniopora pedunculata, Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 218, pl. xvi. figs. 9–11.
„ „ Milne-Edwards and Haime, Cor., iii. p. 190.

A small piece which evidently formed the outer portion of a specimen of this species was obtained.

The depth of the calicles is generally slightly less than their width. The walls are irregularly thickened and perforated, and very nearly indistinguishable in a section of the corallum. The septa are somewhat thickened and narrow, with rather short teeth.

Locality.—Mactan Island, Philippines.

Genus 5. *Rhodaræa*, Milne-Edwards and Haime.

Rhodaræa, Milne-Edwards and Haime, Cor., iii. p. 183.
„ Duncan, Rev. Madrep., p. 188.

Two species of this genus were obtained.

1. *Rhodaræa tenuidens*, n. sp. (Pl. VIII. figs. 7–7*b*).

Corallum subglobose, massive, incrusting at the base, with a narrow, free edge and a thin, distinct epitheca. Calicles scarcely polygonal, subcircular, rather deep, about 3 mm. wide; wall very porous and thin, very much thickened at the points where many cups meet. Septa of three cycles, the last very rudimentary, those of the first and second cycles almost trabeculate and raggedly spinulous below, not distinct above from the porous wall; pali very thin and wide, forming upright, rather broad plates, tending to fill up the cups, often much less elevated, but never forming thick, lobe-like pieces.

This species makes a decided approach to *Alveopora*. It is distinguished from *Rhodaræa calicularis* by the shape of its calicles, the nature of its walls and the characters of its pali. From *Rhodaræa gracilis* it differs in the size and shape of its calicles, and the character of its pali. Two small specimens were obtained.

Localities.—Santa Cruz Major Island, off Samboangan, Philippines, 10 fathoms; Amboina.

2. *Rhodaræa calicularis* (Lamarck).

Astræa calicularis, Lamarck, Hist. Anim. sans Vert., ii. p. 266, 1816.
Rhodaræa calicularis, Milne-Edwards and Haime, Cor., iii. p. 183.

A large portion of a very large, subglobose specimen was obtained. The walls are rather strong and uniformly thick in each calicle, but are very variable at different parts of the corallum; in some places it is low and thick, marked above by the narrow septa; in other places it is elevated and thinner, with the septal marking scarcely distinct. In the shallow calicles the pali are very thick, and rounded, very distinct, nearly filling up the cell; in the deeper calicles they are smaller, and much less prominent at the bottom of the cell.

Locality.—Samboangan, Philippines.

Genus 6. *Tichopora*, n. gen.

Corallum compound, porous; gemmation intercalicinal. Walls very slightly developed, extremely trabeculate or porous, those of adjoining calicles adherent or fused together, and barely distinguishable in section separating the septa. Calicles subcircular, rarely subangular, shallow. Septa well developed, of three complete cycles, equal or subequal, all projecting equally to meet the columella where the tertiaries join the secondaries in each system, perforated, trabeculate and slightly echinulate. The interseptal spaces very distinct, deep and regular between the perforated laminæ. Columella well developed, subpapillose or trabeculate, largely formed by the septal ends. Pali represented by thickened, elevated, irregular spinules situated before the second cycle, and almost indistinguishable from the trabeculate ends of the columella.

This genus is extremely close to the fossil genus *Litharæa* from which it is distinguished by the trabeculate, perforated septa, the surfaces of which are nearly smooth within, and by the prominent columella and the paliform spinules. It is distinguished from *Goniopora* by its slightly developed, subcircular wall, which is not elevated to form strong, distinct, trabeculate laminæ, by the equal or subequal, well-developed septa with distinct, wide and deep interseptal spaces, and by the paliform spinules which are more distinct on the central parts of the corallum than on the exterior. From *Rhodaræa* it is distinguished by the slight development of the wall, by the well-developed distinct septa and interseptal spaces, by the abundant columella, and the indistinct paliform spinules.

Tichopora tenella, n. sp. (Pl. XI. figs. 1–1*a*).

Corallum extremely porous, somewhat elevated or ovoid, rounded above, and thicker than at the basal part where it incrusts and sometimes surrounds nodules of foreign matter. Gemmation rapidly taking place in the open spongy tissue enclosed between the walls of three or four adjoining calicles. Wall extremely porous and fragile, so as to be very easily broken away, often quite thin, scarcely raised; the line of union generally apparent externally between the calicles, but very indistinct in section. Calicles from about 5 to 6 mm. wide, quite shallow, nearly circular, sometimes oval or subpolygonal. Three cycles complete, a fourth occasionally represented in the larger cups. Septa thin, forming regularly perforated or trabeculate laminæ quite distinct in section, very echinulate exteriorly, but sparsely so deep down in the interseptal chambers. Pali, consisting of six irregular projections placed before the secondaries, scarcely distinct from the trabeculate spinulose ends of the columella, which forms a marked projection in the centre of the calicles.

This species, though different in essential structure, has a very close external resemblance to *Litharæa websteri*, and might easily be mistaken for a recent form of that species. Only a single small specimen was obtained.

Locality.—Samboangan, Philippines.

Genus 7. *Alveopora*, Quoy and Gaimard.

Alveopora (pars), Quoy and Gaimard, Voy. de l'Astrol., Zooph., p. 238.
„ Milne-Edwards and Haime, Cor., iii. p. 193.
„ Duncan, Rev. Madrep., p. 190.

A single species of this very interesting genus was obtained.

Alveopora retusa, Verrill.

Alveopora retusa, Verrill, Bull. Mus. Comp. Zoöl. Cambridge, U.S.A., i. p. 43.

A single small specimen, on which an abundantly developed pellicular epitheca is present, was obtained. The growth of the upper portion of the main lobe of the specimen has been disturbed, evidently owing to injury caused by some foreign body which has settled upon it, the position of which can easily be seen. On this lobe, and especially on its basal portion, the cells are rather small and shallow, with thickened, irregular, spiniform septa, which are seldom more than twelve in number, while the wall is irregularly fenestrate and thickened, and spinulose at its free edge. On a smaller basal lobe the typical structure of the species is more clearly seen, but the characteristic third cycle is not complete.

Locality.—Somerset, Cape York, 5 fathoms.

HYDROCORALLINÆ.

Family Milleporidæ.

Genus *Millepora*, Linnæus.

Millepora (pars), Linnæus, Syst. Nat., ed. 10, p. 790.
„ Milne-Edwards and Haime, Cor., iii. p. 225.
„ Moseley, Zool. Chall. Exp., pt. vii. p. 18.

Through the researches of Professor Moseley, who has confirmed and extended the observations of Louis Agassiz as to the hydroid nature of the Milleporidæ, we have an accurate knowledge of the structure and affinities of *Millepora*. By the discovery of ampullæ[1] on the new species, *Millepora murrayi*, I have been able to give additional confirmation to the opinion of Professor Moseley on the classification of *Millepora*. The ampullæ, which are described under *Millepora murrayi*, do not seem to differ in any marked particular from those of the Stylasteridæ.

Eight species of the genus were obtained.

1. *Millepora alcicornis*, Linnæus.

Millepora alcicornis, Linnæus, Syst. Nat., ed. 10, p. 791.
„ „ Dana, Zoophytes, p. 543.

Three specimens of this species were obtained. One, from Bermuda, consists of a very large, curved, flabellate cœnosteum, formed by numerous very coalescent branches

[1] *Nature*, 1884, p. 539.

and branchlets in the same plane, which become quite free and somewhat divergent above. The fenestræ between the coalescent branches are of very different sizes, but are small, and obsolescent towards the basal part which forms a solid mass. A large specimen from St. Thomas differs in being much more unevenly grown, with shorter and thicker branches. The surface is much more uneven, and the pores more conspicuous.

A third specimen, which was obtained at Bermuda, and which does not seem to differ essentially from this species, is peculiar in many respects. It consists of a few small branches growing on an old and broken black bottle, over which, within and without, the basal part of the cœnosteum has spread as a thin incrusting layer. The branches are rather unequally compressed, sometimes coalescing, and palmato-digitate above. The surface of the cœnosteum is of a delicate, reddish-brown colour, and is much more uneven than in the normal form. The cyclosystems are crowded over the surface, and the gastropores are very large.

Very valuable and interesting remarks on the species have been made by Pourtalès,[1] and he points out the great variation to which it is subject. A very good figure of the species is given in the Report on the Florida Reefs, pl. xx.

Localities.—Bermuda; St. Thomas, West Indies.

2. *Millepora carthaginiensis*, Duchassaing and Michelotti.

Millepora carthaginiensis, Duchassaing and Michelotti, Suppl. Mém. Cor. des Antilles, p. 102, pl. xi. fig. 6.

A single large specimen, apparently referable to this species, was obtained. The branches and branchlets are small, slender, and parallel; extremely elongated, and very coalescent, forming broad laminæ with narrow, elongated fenestræ. Often the branches are free throughout all their length, and form long, rod-like, upright pieces. The cyclosystems are very distinct, the gastropores being rather large and sunk in small, shallow depressions. Owing to these small depressions the surface is slightly uneven.

From the foregoing description it will be seen that this species, like the many others described by Duchassaing and Michelotti from the West Indies, is very closely related to *Millepora alcicornis*, and it is very probable, as suggested by Pourtalès, that they are all but varieties of one and the same species.

Locality.—St. Thomas, West Indies.

3. *Millepora murrayi*, Quelch (Pl. VII. figs. 5–5*e*).

Millepora murrayi, Quelch, Nature, 1884, p. 539.

Cœnosteum consisting of dense clusters of broad and thin, compressed, frond-like branches, which are extremely coalescent, and broadly palmate at the ends. The fronds

[1] Illustr. Cat. Mus. Comp. Zool., No. iv.

formed by the coalescent branches and branchlets are often as much as 5 cm. wide, and the thickness of the fronds and branches throughout is uniformly about 5 mm. The broadened extremities of the branches trend horizontally, and become divided vertically into parallel branchlets, which often remain laterally fused, and give a ribbed appearance to the lower part of the frond. The branchlets in their free portion are sometimes as much as 2 cm. long, though they are generally much shorter and irregular, somewhat compressed, about 3 mm. thick, slightly tapering, and rounded at the end; in developing, these branchlets elongate, curve outwards, become horizontally directed, and broadened out into thin, compressed, vertical fronds, from 2 to 5 cm. wide, which become in turn divided vertically into numerous irregular, small, parallel branchlets; these fronds either coalesce laterally with other fronds, or fuse with opposite ones at their extremity, thus forming bridge-like pieces. The surface of the cœnosteum is nearly smooth, being finely and evenly reticulated. The pores are small and scattered irregularly, often scarcely distinguishable over large areas of the cœnosteum; the gastropores are about 0·25 mm. in diameter, and rather wide apart; the dactylopores are very minute and generally very numerous, less abundant on the apical parts of the branchlets and on the basal parts of the colony. Ampullæ developing as special cavities in the superficial meshwork of the cœnenchyma; often crowded, about 0·75 mm. in diameter within, scarcely raised above the general surface, on which they are seen as small white spots or vesicles, which are about 0·5 mm. in diameter, the centre being generally pierced by a small pore.

This species is close to the *Millepora tortuosa*, from the Fiji Islands, but can easily be distinguished from it. I have named it in honour of Mr. John Murray, whose observations on the living zooids of *Millepora* so materially aided Professor Moseley in his researches on the genus.

On dry specimens which have been kept for some time, and on which ampullæ occur, it is easy to demonstrate their presence by the comparatively large pits which are formed over the surface by the abrasion of the thin, upper layer which covers them, and which are easily distinguishable from the minute pores of the cyclosystems.

Locality.—Samboangan, Philippines.

4. *Millepora ramosa*, Pallas.

Millepora alcicornis, var. *ramosa*, Pallas, Elench. Zooph., p. 261.
Millepora ramosa, Dana, Zoophytes, p. 544.

Two specimens of this species are in the collection. The main stems are large and strong, being as much as 2·5 cm. in diameter at the base, and the branches rise to a comparatively great height. The cyclosystems are generally well marked; the gastropores are slightly larger than the dactylopores, but both are small.

Professor Moseley remarks that *Millepora ramosa* seems to thrive best in the shade.[1]

Locality.—Bermuda.

5. *Millepora intricata*, Milne-Edwards and Haime.

Millepora intricata, Milne-Edwards and Haime, Cor., iii. p. 229, pl. F 2, fig. 2.

A single small specimen occurs in the collection. The pores in this species are arranged in more or less regular cyclosystems, though numerous dactylopores are scattered throughout the surface of the cœnosteum. The pores are very small, and the dactylopores especially are very minute.

Locality.—Amboina.

6. *Millepora confertissima*, n. sp. (Pl. VII. figs. 4–4*a*).

Cœnosteum consisting of an extremely dense, flat-topped, almost square clump of closely interlaced branches and branchlets, which are intimately coalescent, and so closely placed as to leave only very small and narrow openings between them. Branches compressed and very small, about 4 mm. thick, but generally much wider, very closely and shortly ramose, and often forming fronds by lateral coalescence of its branchlets. Branchlets very small, short, and compressed, from about 5 to 7 mm. long, often less, about 4 mm. wide and 2 mm. thick, subpalmate, bearing a few obtuse, smaller branchlets. Surface very smooth and even. Pores unequal, and not distinctly gathered into cyclosystems; gastropores very small, rather wide apart; dactylopores very minute and numerous. Ampullæ absent.

The peculiarly packed and intimate branching of this species gives it a striking habit, which will easily distinguish it.

Locality.—Ternate.

7. *Millepora nodosa*, Esper.

Millepora alcicornis, var. *nodosa*, Esper, Pflanz., i. p. 199, Millep. pl. ix.
Millepora nodosa, Moseley, Zool. Chall. Exp., part vii. p. 13.

Several fragments and small specimens were obtained. Special interest attaches to this form, since it was on specimens of this species of the genus that the classical researches of Professor Moseley were based.

Locality.—Tahiti.

[1] Notes by a Naturalist on the Challenger, p. 27.

8. *Millepora gonagra*, Milne-Edwards and Haime.

Millepora gonagra, Milne-Edwards and Haime, Cor., iii. p. 230, pl. F 3, fig. 1.

Three specimens occur in the collection. The cœnosteum in the very young stages takes on the peculiar, small-lobed form of the large specimens, and differs in this respect from the long-ridged forms of the young specimens of *Millepora verrucosa*; nevertheless the two species are very closely allied. The pores are scattered irregularly; but often the dactylopores are gathered in large numbers around the gastropores.

Localities.—Samboangan, Philippines; Kandavu; Tahiti.

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Note.—Synonyms are printed in *italics;* when more than one reference is given for any genus or species, the most important is indicated by the darker type.

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stellulata, *Blainv.*,	...	...	16, 19, 168
ULANGIA stokesana, *Edw. and H.*,	...	...	28
ULOPHYLLIA, *Edw. and H.*,	...	...	45, 80, 88
aspera, *n. sp.*,	III.	5	24, 88, 89
cellulosa, *n. sp.*,	III.	6	24, 89
UNDARIA, *Oken*,	...	...	116, 123
ZOOPILUS,	...	...	143, 144
echinatus, *Dana*,	...	...	18

PLATE I.

PLATE I.

Fig. 1. *Stylophora flabellata*, a part of the corallum; natural size.

Fig. 1*a*. A calicle; magnified. Surface view.
Fig. 1*b*. The inside of a calicle; magnified.

Fig. 2. *Stylophora cellulosa*, a part of a branch; natural size.

Fig. 2*a*. A typical calicle; magnified. Surface view.
Fig. 2*b*. Magnified view of the inside of a calicle, taken from the extreme apex of a branchlet.
Fig. 2*c*. Magnified view of the inside of a typical calicle.

Fig. 3. *Pocillopora paucistellata*, a part of the corallum; natural size.

Fig. 3*a*. A part of the surface with calicles; magnified.

Fig. 4. *Pocillopora solida*, the main portion of the corallum; natural size.

Fig. 4*a*. A part of the surface, with verrucæ; magnified.
Fig. 4*b*. One of the verrucæ; more highly magnified.
Fig. 4*c*. A magnified view of apical calicles, to show the stages in the development of tabulæ.
Fig. 4*d*. A vertical section of a part of the apex of a branchlet; magnified.

Fig. 5. *Oculina recta*, a part of the corallum; natural size.

Fig. 5*a*. A calicle; magnified.
Fig. 5*b*. A vertical section of a calicle; magnified.

Fig. 6. *Oculina coronalis*, a part of the corallum; natural size.

Fig. 6*a*. A small branchlet; natural size.
Fig. 6*b*. A calicle; magnified.
Fig. 6*c*. A vertical section of a calicle; magnified.

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1. STYLOPHORA FLABELLATA. 2. S. CELLULOSA. 3. POCILLOPORA PAUCISTELLATA.
4. P. SOLIDA. 5. OCULINA RECTA. 6. O. CORONALIS.

PLATE II.

PLATE II.

Fig. 1. *Seriatopora conferta*, a part of the corallum; natural size.

Fig. 1*a*. A typical calicle; magnified. Surface view.
Fig. 1*b*. A basal calicle; magnified. Surface view.
Fig. 1*c*. A magnified view of the inside of a distal calicle.

Fig. 2. *Seriatopora aculeata*, a part of the corallum; natural size.

Fig. 2*a*. A calicle; magnified. Surface view.
Fig. 2*b*. A magnified view of the inside of a calicle.
Fig. 2*c*. A magnified view of the distal, intercalicular surface.

Fig. 3. *Seriatopora crassa*, a part of the corallum; natural size.

Fig. 3*a*. A calicle; magnified. Surface view.
Fig. 3*b*. A magnified view of the inside of a calicle.
Fig. 3*c*. *Seriatopora crassa*, var. *transversa*, a calicle; magnified. Surface view.
Fig. 3*d*. *Seriatopora crassa*, var. *transversa*; a magnified view of the inside of a calicle.

Fig. 4. *Seriatopora stellata*, a part of the corallum; natural size.

Fig. 4*a*. A calicle; magnified. Surface view.
Fig. 4*b*. A magnified view of the inside of a calicle.

Fig. 5. *Symphyllia acuta*, the corallum; natural size.

Fig. 5*a*. A part of the wall with septa and dissepiments; transverse section.
Fig. 5*b*. A part of the wall with septa; vertical section.

Fig. 6. *Mussa brueggemanni*, a part of the corallum; natural size.

Fig. 6*a*. An isolated calicle; natural size.
Fig. 6*b*. A part of the wall with septa and dissepiments; transverse section.

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1. SERIATOPORA CONFERTA. 2. S. ACULEATA. 3. S. CRASSA. 4. S. STELLATA
5. SYMPHYLLIA ACUTA 6. MUSSA BRUEGGEMANNI.

PLATE III.

PLATE III.

Fig. 1. *Physogyra aperta*, a part of the corallum; natural size.

Fig. 1*a*. A part of the wall, with dissepiments; vertical section.

Fig. 2. *Goniastræa multilobata*, a part of the corallum; natural size

Fig. 2*a*. Magnified view of an elongated calicle, with developing centres.
Fig. 2*b*. A vertical section of a calicle; magnified.
Fig. 2*c*. A view of the dissepiments, as seen in a vertical section through the centre of a calicle.

Fig. 3. *Goniastræa coronalis*, a part of the corallum; natural size.

Fig. 3*a*. A calicle; magnified.

Fig. 4. *Goniastræa laxa*, a part of the corallum; natural size.

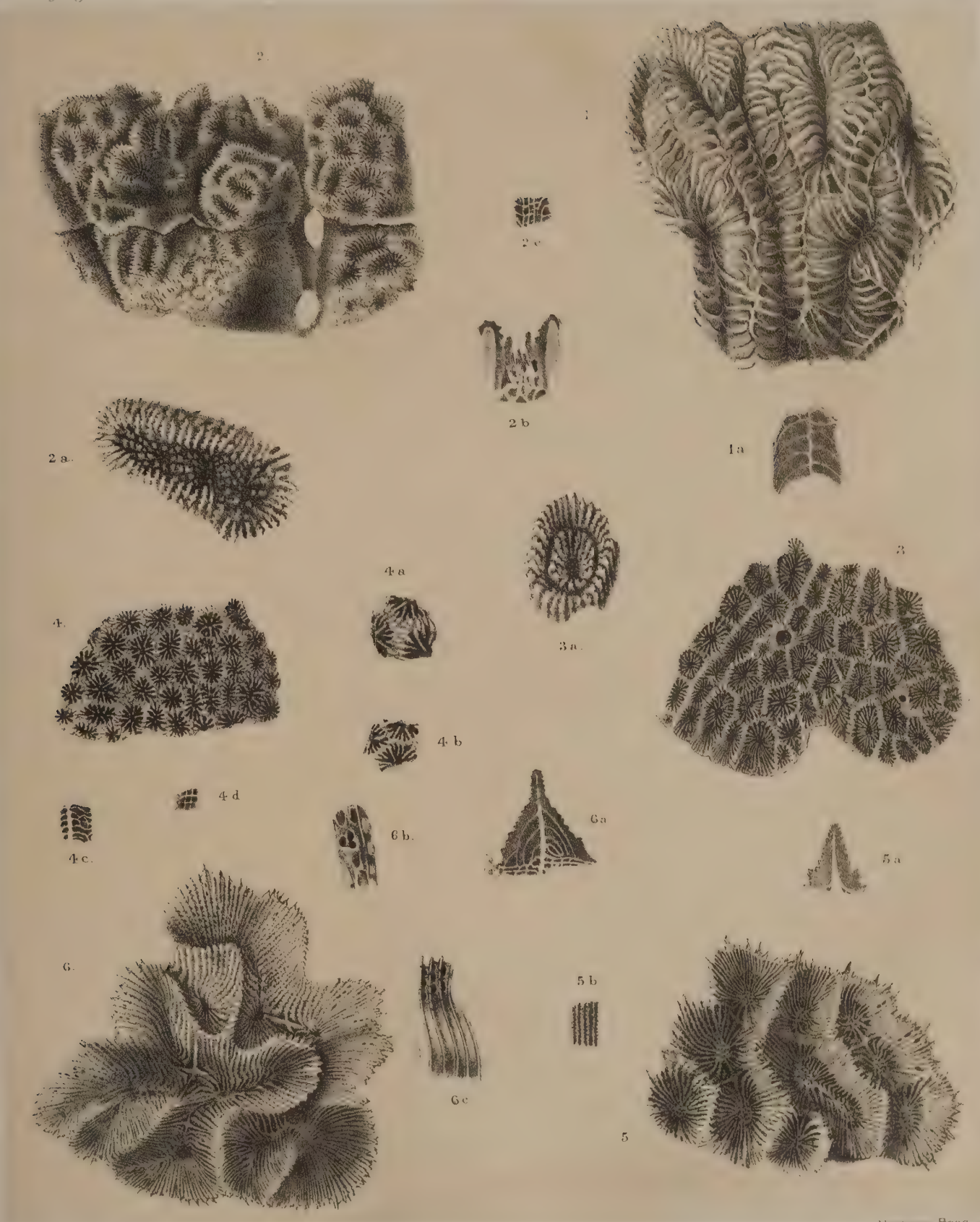
Fig. 4*a*. A surface view of the wall where it is much thickened.
Fig. 4*b*. A surface view of the wall where it is thin.
Fig. 4*c*. A vertical section of a part of the wall, with dissepiments.
Fig. 4*d*. A view of septa and dissepiments, as seen in a vertical section through the centre of the calicle.

Fig. 5. *Ulophyllia aspera*, a part of the corallum; natural size.

Fig. 5*a*. A vertical section of a part of the wall, with opposite septa.
Fig. 5*b*. A view of a part of the under surface, with costæ.

Fig. 6. *Ulophyllia cellulosa*, a part of the corallum; natural size.

Fig. 6*a*. A vertical section of a part of the wall, with septa and dissepiments.
Fig. 6*b*. A view of the under surface, with vesicles and costæ.
Fig. 6*c*. A lateral view of a part of a ridge, with the septa rubbed down to lay bare the abundant endotheca.



A. Sawan. del et L. a.

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1. PHYSOGYRA APERTA. . GONIASTRÆA MULTILOBATA. 3. [illegible]
4. G. LAXA. 5. ULOPHYLLIA ASPERA. 6. U. CELLU[illegible]

PLATE IV.

PLATE IV.

Fig. 1. *Phymastræa aspera*, a part of the corallum ; natural size.

Fig. 1*a*. A vertical section of a part of the wall, with septa and intermural spaces ; magnified.
Fig. 1*b*. A transverse section across a part of three calicles, with intermural spaces.

Fig. 2. *Acanthastræa irregularis*, a part of the corallum ; natural size.

Fig. 2*a*. A magnified view of the wall at the junction of five calicles, with septa

Fig. 3. *Cyphastræa aspera*, the corallum ; natural size.

Fig. 3*a*. A magnified view of a calicle.

Fig. 4. *Cyphastræa brueggemanni*, the corallum ; natural size.

Fig. 4*a*. A part of the corallum ; magnified.

Fig. 5. *Galaxea aspera*, a part of the corallum ; natural size.

Fig. 5*a*. A lateral view of a calicle (restored).
Fig. 5*b*. A section of the cells of the peritheca.
Fig. 5*c*. The cells of the peritheca ; surface view.
Fig. 5*d*. A calicle, seen from above ; magnified.

Fig. 6. *Galaxea explanata*, a part of the corallum ; natural size.

Fig. 6*a*. A calicle, seen from above ; magnified.
Fig. 6*b*. A lateral view of a calicle.
Fig. 6*c*. A section of the cells of the peritheca.
Fig. 6*d*. The cells of the peritheca ; surface view.

Fig. 7. *Galaxea fragilis*, a part of the corallum ; natural size.

Fig. 7*a*. A calicle, seen from above ; magnified.
Fig. 7*b*. A lateral view of a calicle (restored).
Fig. 7*c*. A section of the cells of the peritheca.
Fig. 7*d*. The cells of the peritheca ; surface view.

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1. PHYMASTRÆA ASPERA 2. ACANTHASTRÆA IRREGULARIS. 3. CYPHASTRÆA ASPERA
4. C. BRUEGGEMANNI 5. GALAXEA ASPERA 6. G. EXPLANATA 7. S. FRAGILIS.

PLATE V.

PLATE V.

Fig. 1. *Merulina prolifera*, a part of the corallum; natural size.

Fig. 1*a*. A branchlet; magnified.

Fig. 2. *Oxypora contorta*, a part of the corallum; natural size.

Fig. 2*a*. Two calicles; magnified.
Fig. 2*b*. A part of the under surface.

Fig. 3. *Tichoseris obtusata*, the corallum; natural size.

Fig. 3*a*. A transverse section, showing isolated as well as seriate calicles, with solid walls; magnified.
Fig. 3*b*. A magnified view of the marginal part of a calicle, with synapticulæ.
Fig. 3*c*. A vertical section of the corallum, with endotheca; magnified.

Fig. 4. *Domoseris porosa*, a part of the corallum; natural size.

Fig. 4*a*. A calicle; magnified.
Fig. 4*b*. A magnified view of the upper part of the septo-costæ, as seen in a vertical section parallel to their direction.
Fig. 4*c*. A magnified view of the septo-costæ, as seen in a vertical section, transverse to their direction.

Fig. 5. *Domoseris solida*, a part of the corallum; natural size.

Fig. 5*a*. A calicle; magnified.

Fig. 6. *Domoseris regularis*, a part of the corallum; natural size.

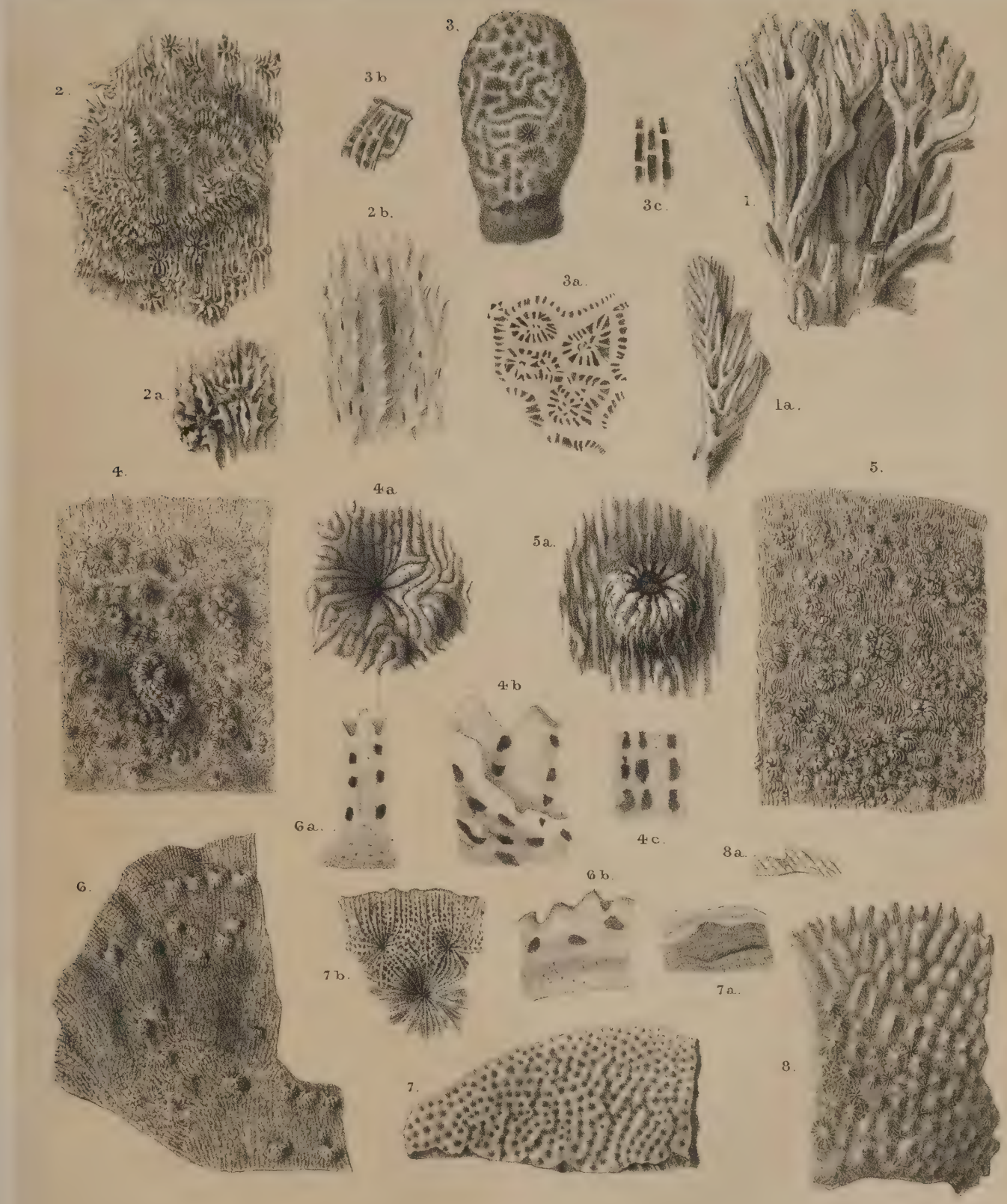
Fig. 6*a*. A magnified view of a vertical section of the corallum, transverse to the direction of the septo-costæ.
Fig. 6*b*. A magnified view of a vertical section of the corallum, parallel to the direction of the septo-costæ.

Fig. 7. *Agaricia regularis*, a part of the corallum; natural size.

Fig. 7*a*. The under surface of the corallum, with sub-concentric ridges.
Fig. 7*b*. The marginal part of the corallum; magnified.

Fig. 8. *Hydnophora tenella*, a part of the corallum; natural size.

Fig. 8*a*. A transverse section showing the thinness of the corallum.



A. Gawan del et lith. Mintern Bros. imp.

1. MERULINA PROLIFERA. 2. OXYPORA CONTORTA. 3. TICHOSERIS OBTUSATA. 4. DOMOSERIS POROSA
5. D. SOLIDA. 6. D. REGULARIS. 7. AGARICIA REGULARIS. 8. HYDNOPHORA TENELLA

PLATE VI.

PLATE VI.

Fig. 1. *Fungia tenuidens*, the upper surface of the corallum; natural size.

Fig. 1*a*. A portion of the under surface; natural size.

Fig. 2. *Fungia rugosa*, a part of the upper surface; natural size.

Fig. 2*a*. A part of the under surface; natural size.

Fig. 3. *Cycloseris discus*, the upper surface of the corallum; natural size.

Fig. 3*a*. The under surface; natural size.

Fig. 4. *Cylloseris incrustans*, the corallum; natural size.

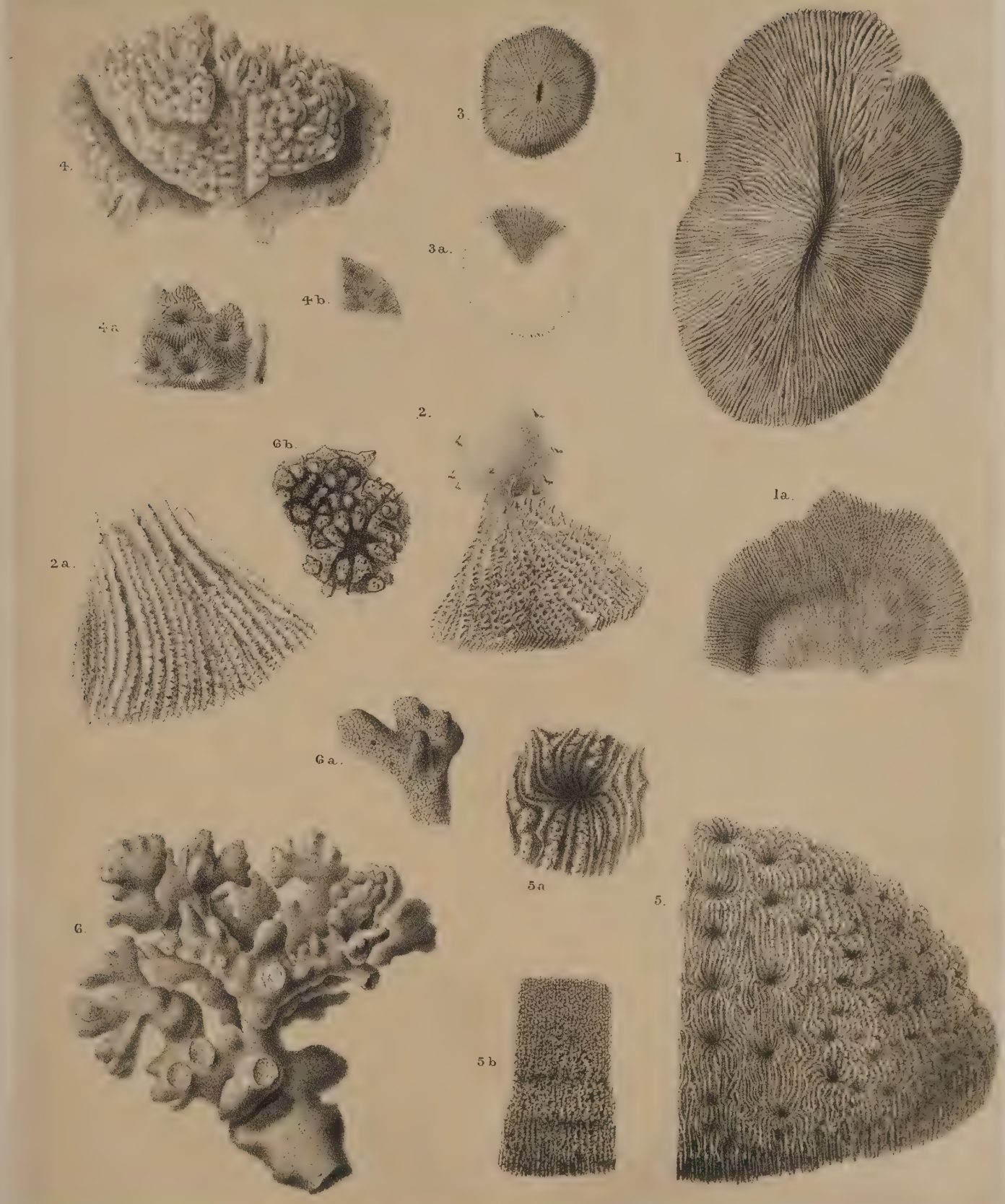
Fig. 4*a*. A part of the corallum; magnified.
Fig. 4*b*. A part of the under surface.

Fig. 5. *Podabacia robusta*, a part of the corallum; natural size.

Fig. 5*a*. A calicle; magnified.
Fig. 5*b*. A marginal part of the under surface.

Fig. 6. *Psammocora ramosa*, a part of the corallum; natural size.

Fig. 6*a*. A branchlet; magnified.
Fig. 6*b*. A part of the surface; more highly magnified.



A. Gawan del et lith. Mintern Bros. imp.

1.FUNGIA TENUIDENS. 2.F. RUGOSA. 3.CYCLOSERIS DISCUS
4.CYLLOSERIS INCRUSTANS. 5. PODABACIA ROBUSTA. 6.PSAMMOCORA RAMOSA.

PLATE VII.

PLATE VII.

Fig. 1. *Sandalolitha dentata*, the corallum ; natural size.

Fig. 1*a*. A part of the under surface ; natural size.
Fig. 1*b*. A part of the under surface ; magnified.
Fig. 1*c*. Teeth of the septa ; magnified.
Fig. 1*d*. View of a part of the corallum, showing an early stage in the development of a young calicle.

Fig. 2. *Dendrophyllia conferta*, a part of the corallum ; natural size.

Fig. 2*a*. Oblique view of a typical calicle, with buds.
Fig. 2*b*. A calicle, seen from above.

Fig. 3. *Turbinaria æqualis*, a part of the corallum ; natural size.

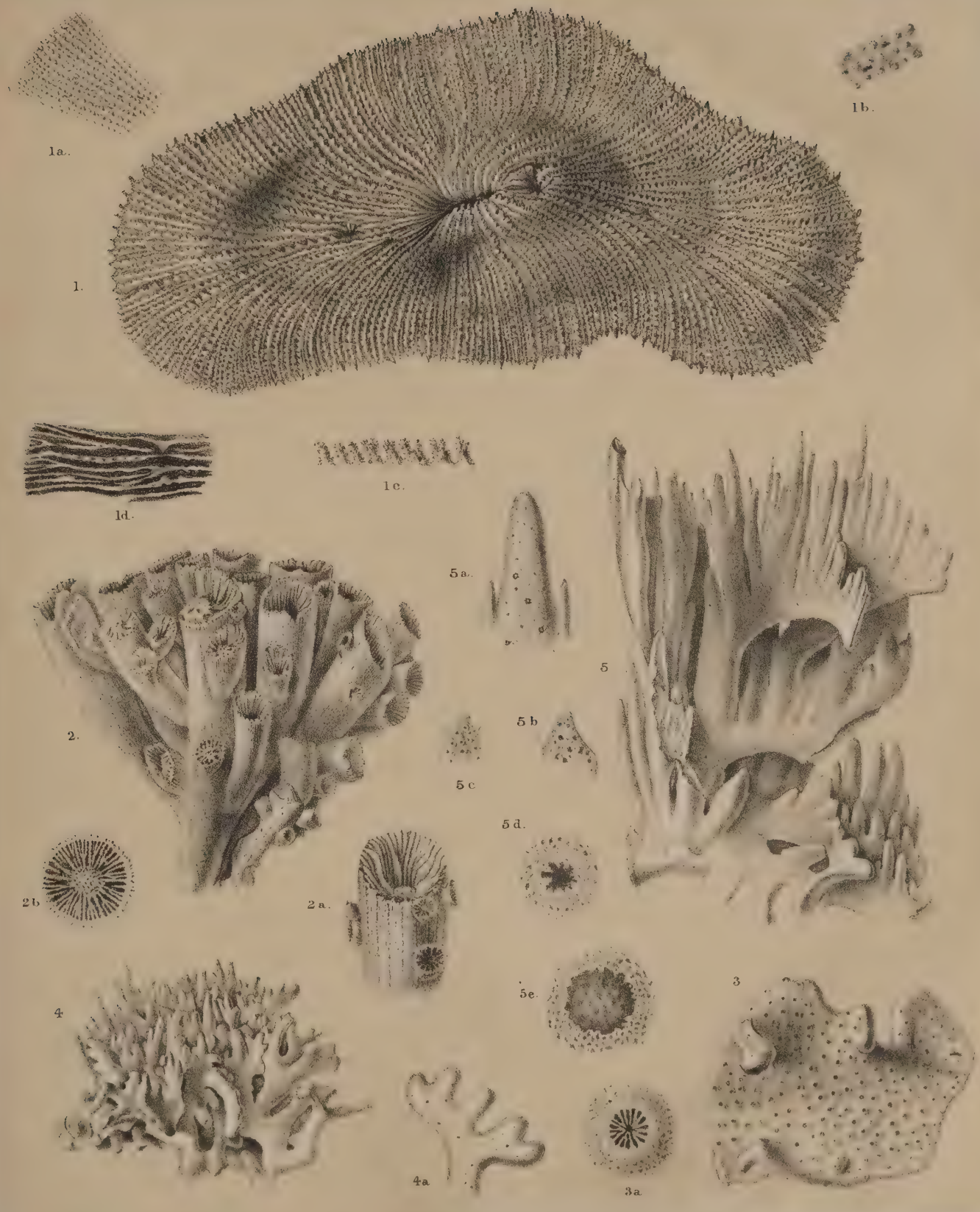
Fig. 3*a*. A calicle ; magnified.

Fig. 4. *Millepora confertissima*, a part of the cœnosteum ; natural size.

Fig. 4*a*. A branchlet ; magnified.

Fig. 5. *Millepora murrayi*, a part of the cœnosteum ; natural size.

Fig. 5*a*. A part of the surface ; magnified.
Fig. 5*b*. A branchlet with ampullæ ; abraded.
Fig. 5*c*. A branchlet with ampullæ ; not abraded.
Fig. 5*d*. An ampulla, as seen in "5*c*" ; magnified.
Fig. 5*e*. An ampulla, as seen in "5*b*" ; magnified.



A. Gavan del et lith.

Mintern Bros. imp.

1. SANDALOLITHA DENTATA. 2. DENDROPHYLLIA CONFERTA. 3. TURBINARIA ÆQUALIS
4. MILLEPORA CONFERTISSIMA. 5. M. MURRAYI.

PLATE VIII.

PLATE VIII.

Fig. 1. *Montipora fragilis*, a part of the corallum; natural size.

Fig. 1*a*. A calicle with papillæ; magnified.
Fig. 1*b*. Papillæ of the distal surface; magnified.

Fig. 2. *Montipora levis*, a part of the corallum; natural size.

Fig. 2*a*. A calicle; magnified.

Fig. 3. *Montipora obtusata*, the corallum; natural size.

Fig. 3*a*. A calicle; magnified.

Fig. 4. *Montipora irregularis*, a part of the corallum; natural size.

Fig. 4*a*. The wall and calicles; magnified.

Fig. 5. *Montipora exserta*, a part of the corallum; natural size.

Fig. 5*a*. A calicle; magnified.
Fig. 5*b*. Oblique view of a calicle; more highly magnified.

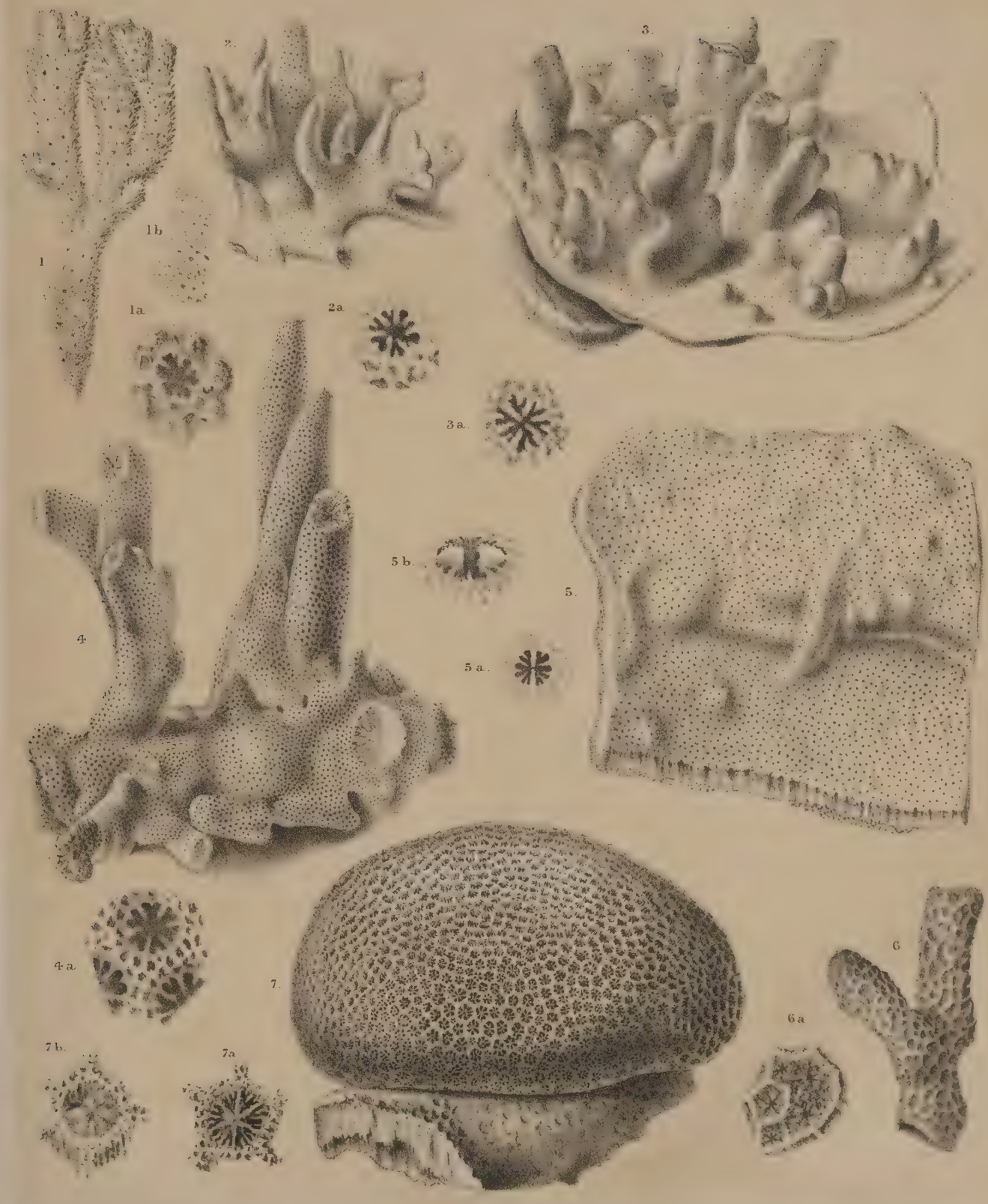
Fig. 6. *Napopora irregularis*, a part of the corallum; natural size.

Fig. 6*a*. Calicles; magnified.

Fig. 7. *Rhodaræa*[1] *tenuidens*, the corallum; natural size.

Fig. 7*a*. A calicle; magnified.
Fig. 7*b*. Oblique view of a calicle; magnified.

[1] Not *Rhodaryhæa* as on the Plate.



A Gawan del et lith

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1. MONTIPORA FRAGILIS. 2. M. LEVIS. 3. M. OBTUSATA. 4. M. IRREGULARIS.
5. M. EXSERTA 6. NAPOPORA IRREGULARIS. 7. RHODARRHŒA TENUIDENS

PLATE IX.

PLATE IX.

Fig. 1. *Madrepora manni*, a part of the corallum; natural size.

Fig. 1*a*. Lateral calicles; magnified.

Fig. 2. *Madrepora canalis*, a part of the corallum; natural size.

Fig. 2*a*. Lateral calicle; magnified.

Fig. 2*b*. Oblique view of a lateral calicle; magnified.

Fig. 3. *Madrepora parilis*, a part of the upper surface of the corallum; natural size.

Fig. 3*a*. A part of the under surface; natural size.

Fig. 3*b*. A lateral calicle; magnified (the striations on the surface of the calicles are usually much thinner and closer than is shown in the figure).

Fig. 4. *Madrepora minima*, a part of the corallum; natural size.

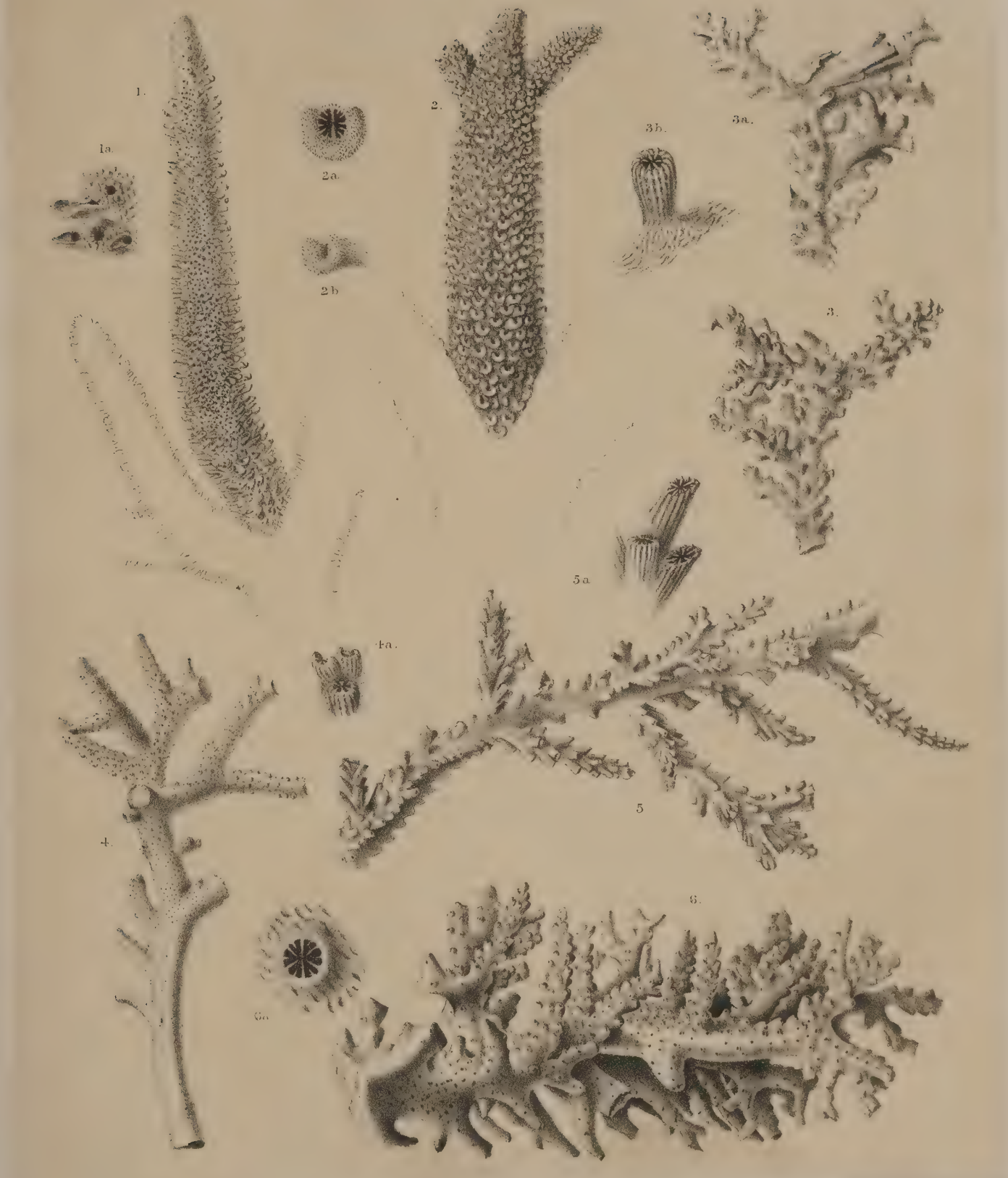
Fig. 4*a*. Calicles; magnified.

Fig. 5. *Madrepora angulata*, a part of the corallum; natural size.

Fig. 5*a*. Calicles; magnified.

Fig. 6. *Madrepora confraga*, a part of the corallum; natural size.

Fig. 6*a*. A calicle; magnified.



A. Gawan del. et lith.

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1. MADREPORA MANNI. 2. M. CANALIS. 3. M. PARILIS
4. M. MINIMA. 5. M. ANGULATA. 6. M. CONFRAGA.

PLATE X.

PLATE X.

Fig. 1. *Madrepora speciosa*, an upper marginal part of the corallum, viewed obliquely: natural size.

Fig. 1*a*. An under marginal part of the corallum; natural size.
Fig. 1*b*. A cluster of calicles; natural size.

Fig. 2. *Madrepora scabrosa*, the upper part of a branch; natural size.

Figs. 2*a*, 2*b*, 2*c*, 2*d*. Different forms of lateral calicles; magnified.
Fig. 2*e*. A circular calicle; magnified.

Fig. 3. *Madrepora conferta*, a part of the corallum; natural size.

Fig. 3*a*. Lateral view of a branchlet; magnified.
Fig. 3*b*. Lateral calicles, seen laterally; magnified.
Fig. 3*c*. A branchlet, seen from above; magnified.

Fig. 4. *Madrepora vastula*, a part of the corallum; natural size.

Fig. 4*a*. Lateral view of a branchlet; magnified.
Figs. 4*b*, 4*c*. Lateral calicles, seen laterally; magnified.

Fig. 5. *Madrepora mirabilis*, a part of the corallum; natural size.

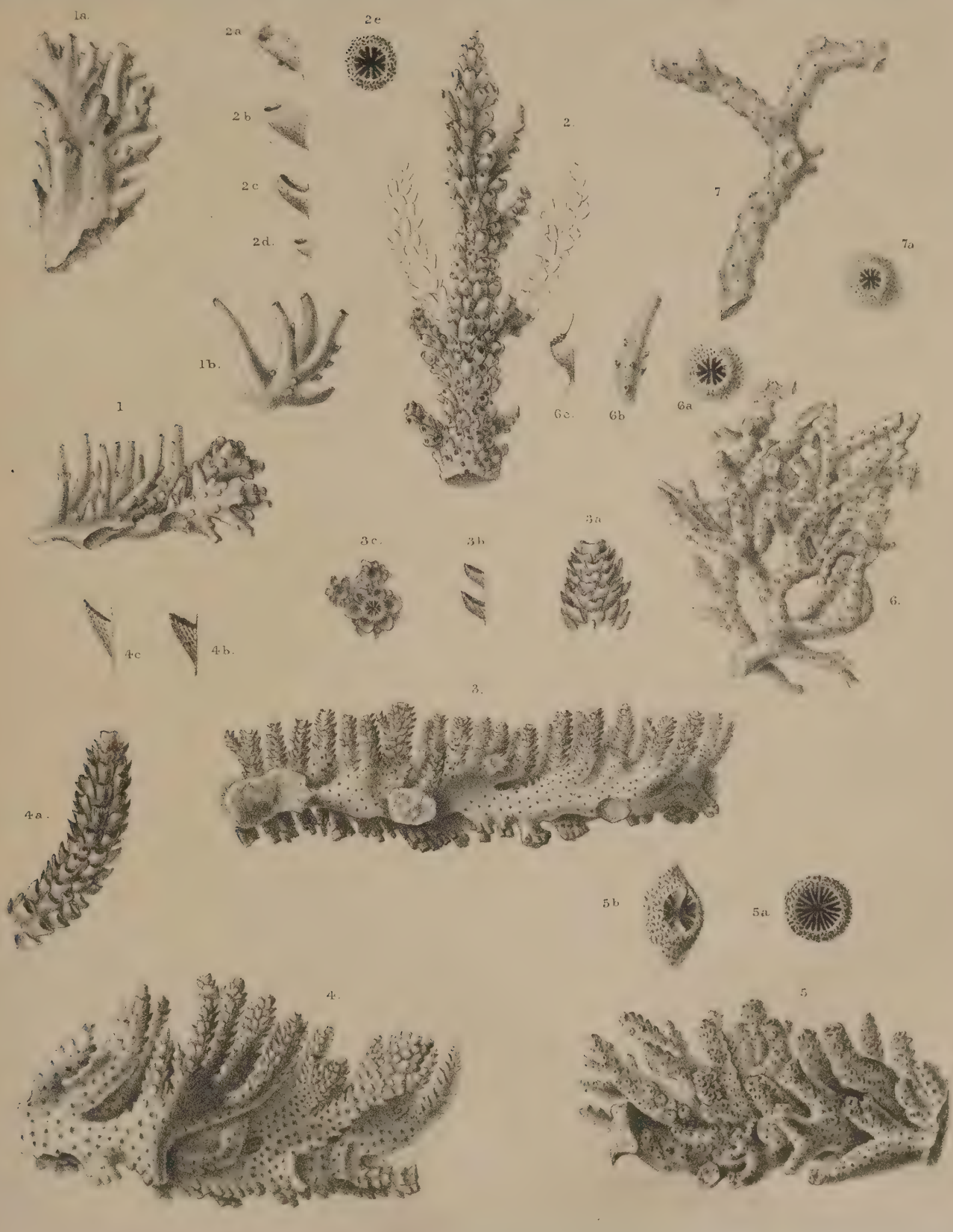
Fig. 5*a*. A terminal calicle, with three complete cycles of septa; magnified.
Fig. 5*b*. A lateral calicle, with two exserted septa; magnified.

Fig. 6. *Anacropora gracilis*, a part of the corallum; natural size.

Fig. 6*a*. A calicle; magnified (the septa are usually less distinct than is shown in the figure).
Fig. 6*b*. An apex of a branchlet, with the terminal mass of cœnenchyma.
Fig. 6*c*. A lateral view of a calicle; magnified.

Fig. 7. *Anacropora solida*, a part of the corallum; natural size.

Fig. 7*a*. A calicle; magnified (the septa are usually less distinct than is shown in the figure).



A. Gawan del et lith

Mintern Bros. imp.

1. MADREPORA SPECIOSA. 2. M. SCABROSA. 3. M. CONFERTA. 4. M. VASTULA.
5. M. MIRABILIS. 6. ANACROPORA GRACILIS. 7. A. SOLIDA

PLATE XI.

PLATE XI.

Fig. 1. *Tichopora tenella*, lateral view of the corallum; natural size. With vertical section.

Fig. 1*a*. Old and young calicles; magnified.

Fig. 2. *Porites crassa*, lateral view of the corallum; natural size.

Fig. 2*a*. The wall and calicles; magnified.

Fig. 3. *Porites explanata*, the corallum; natural size. Viewed from above.

Fig. 3*a*. A calicle with the walls; magnified.

Fig. 4. *Porites crassistellata*, lateral view of the corallum; natural size.

Fig. 4*a*. The wall and calicles; magnified.

Fig. 5. *Porites mirabilis*, lateral view of the corallum; natural size.

Fig. 5*a*. Large and small calicles; magnified.

Fig. 6. *Porites latistellata*, a part of the corallum; natural size.

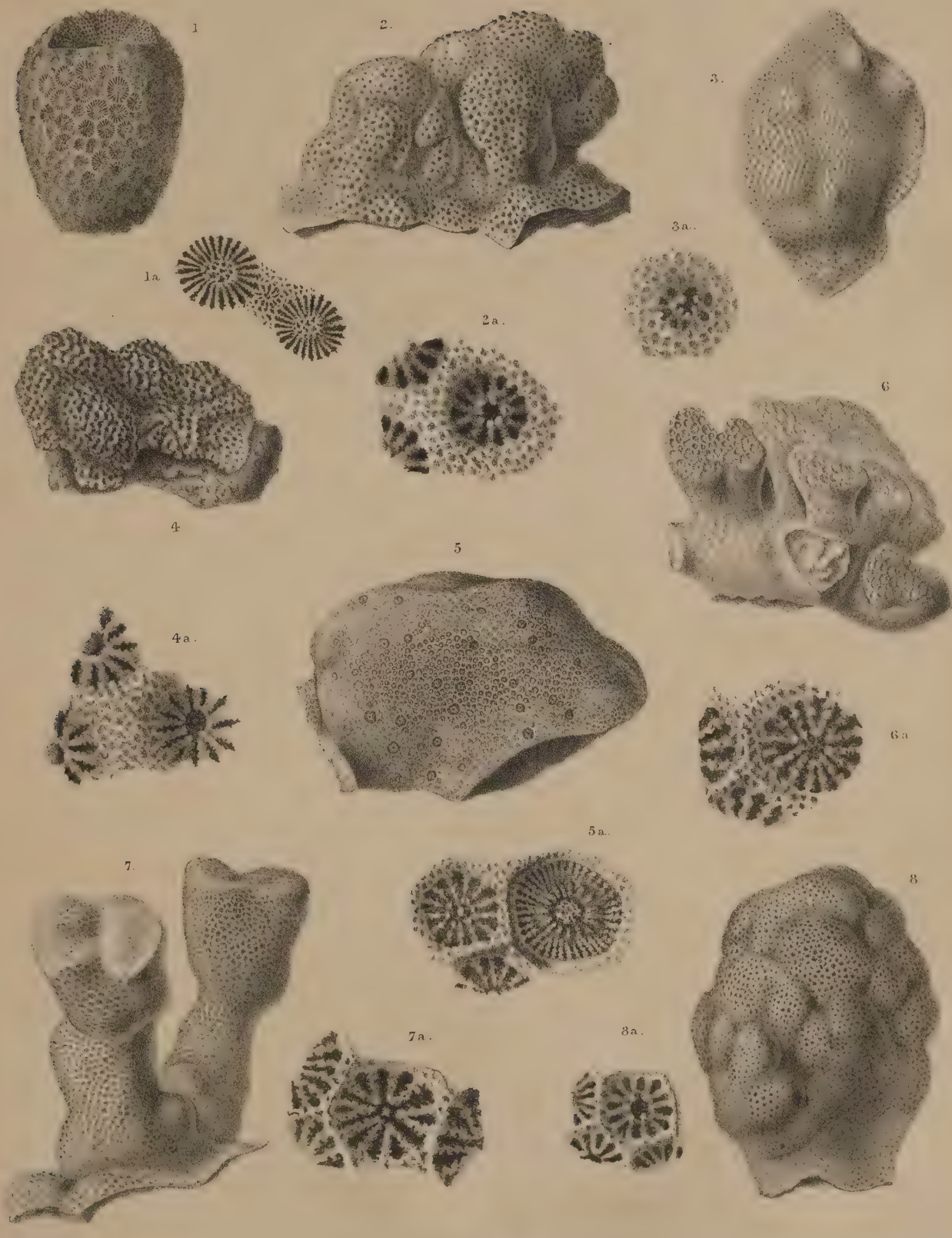
Fig. 6*a*. The wall and calicles; magnified.

Fig. 7. *Porites bulbosa*, a part of the corallum; natural size.

Fig. 7*a*. The wall and calicles; magnified.

Fig. 8. *Porites parvistellata*, lateral view of the corallum; natural size.

Fig. 8*a*. The wall and calicles; magnified.



A. Gawan. del. et lith.

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1. TICHOPORA TENELLA. 2. PORITES CRASSA. 3. P. EXPLANATA. 4. P. CRASSISTELLATA.
5. P. MIRABILIS 6. P. LATISTELLATA. 7. P. BULBOSA. 8. P. PARVISTELLATA.

PLATE XII.

PLATE XII.

Fig. 1. *Moseleya latistellata*, the corallum ; natural size.

Fig. 2. *Moseleya latistellata*, showing the superposition of one primary calicle above another, with a small, developing, superposed calicle.

Fig. 3. *Moseleya latistellata*, a transverse section, showing the tabula and concentric and subconcentric dissepiments.

Fig. 4. *Moseleya latistellata*, a basal view of the primary calicle of the colony, showing the septa meeting at a point, and the sub-infundibuliform tabula (the central portion of the lower tabula has been removed to show the one above it).

Fig. 5. *Moseleya latistellata*, a small calicle which has developed on the basal, primary calicle.

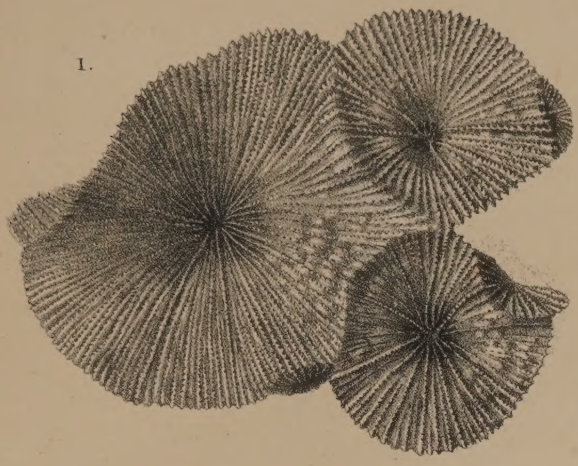
Fig. 6. *Moseleya latistellata*, a part of a vertical section across two calicles, showing the abundant, vesiculate endotheca, and the very slight development of the inner wall.

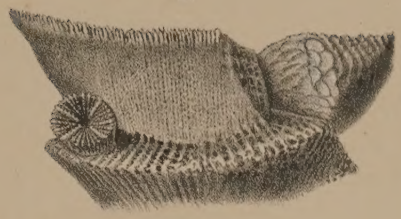
Fig. 7. A diagrammatic representation, on a large scale, of a vertical section, to illustrate the relation of the tabulæ in *Moseleya*, and their probable derivation from the dissepiments.

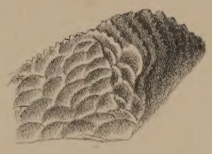
Fig. 8. A slightly enlarged, inner calicle of *Strombodes murchisoni* (after Milne-Edwards and Haime).

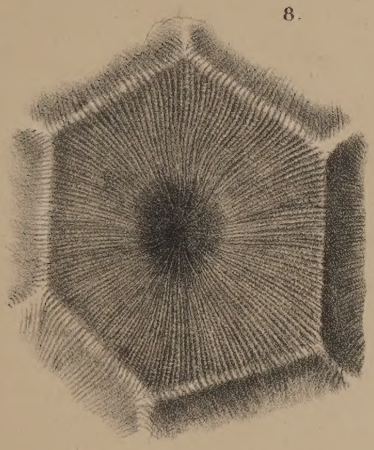
Fig. 9. Calicles of *Cyathophyllum regium* (after Milne-Edwards and Haime).

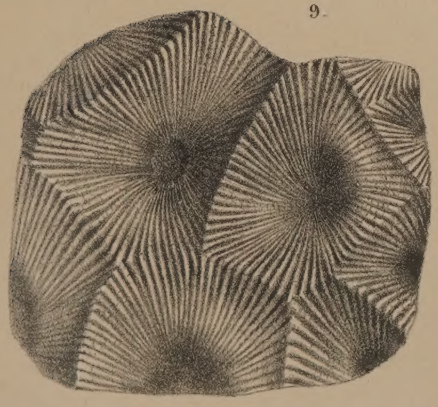
Fig. 10. A transverse section of a calicle of *Cyathophyllum marmini* (after Milne-Edwards and Haime).

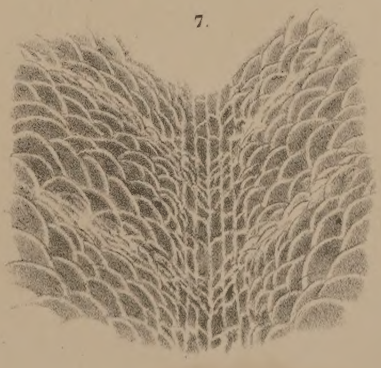


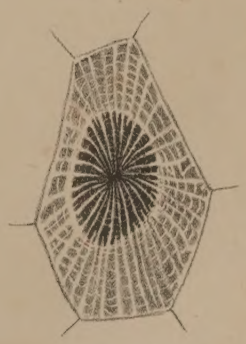












Mintern Bros. imp.

A. Gawan del et lith.

1–7. MOSELEYA LATISTELLATA. 8. STROMBODES MURCHISONI.
9. CYATHOPHYLLUM REGIUM. 10. C. MARMINI